

A
PRACTICAL TREATISE
OF
HUSBANDRY:

Wherein are contained, many
USEFUL and VALUABLE
EXPERIMENTS and OBSERVATIONS
IN THE

NEW HUSBANDRY,

Collected, during a SERIES of YEARS, by the Celebrated

M. DUHAMEL DU MONCEAU,

*Member of the Royal Academy of Sciences at Paris, Fellow of the
Royal Society, London, &c,*

A L S O,

The most approved Practice of the best ENGLISH FARMERS,
in the OLD METHOD of HUSBANDRY.

W I T H

COPPER-PLATES of several new and useful INSTRUMENTS.

The Second EDITION, corrected and improved.

*Agricola incurvo terram dimovit aratro.
Hinc anni labor; hinc patriam, parvosque nepotes
Sustinet; hinc armenta boum, meritosque juvencos.*

VIRG. Geor. l. 2.

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17
PRACTICAL TREATISE

HUSBANDRY:

USEFUL AND VALUABLE

EXPERIMENTS AND OBSERVATIONS

NEW HUSBANDRY

By the Hon. John Lubbock, Esq.

M. B. LAMBERT, D. D. M. D. C. L.

Member of the Royal Society, &c.



The most approved Practice of Husbandry, as it is now conducted in the best Part of the Kingdom.

With a Description of the most improved Machines, and a full Account of the most successful Experiments, &c.

The second Edition, corrected and enlarged.

Printed by J. B. LAMBERT, at the Office of the Royal Society, in Pall Mall.

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MDCCLXX

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TO THE RIGHT HONOURABLE

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Simon, Earl Harcourt,
Hugh, Lord Willoughby of Parham,
Sir George Savile, Bart.
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Edward Hooper, Esq;
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Richard Long, Esq;
William Fitzherbert, Esq;

V I C E - P R E S I D E N T S;

And to the rest of the Lords and Gentlemen, who are of
the SOCIETY for the Encouragement of ARTS,
MANUFACTURES and COMMERCE;

This Second Edition of a practical Treatise of Husbandry,
is inscribed, with the utmost Respect,

By Their most obedient Servant,

John Mills.

To the Right Honourable

LORD ROMNEY, ROBERT,

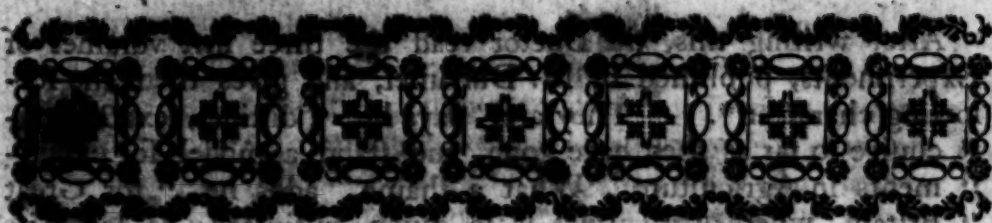
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VIGOROUSLY

And to the rest of the Lords and Gentlemen who are of
the Society of the Friends of the
The second part of a general Treaty of Friendship
is intended, with the most liberal
to the most liberal

John Mills



P R E F A C E.

DUHAMEL and his correspondents have set the world an example which has long been wanted, and greatly desired by all who have the good of their country at heart, and are in the least sensible of the importance of Agriculture. They have given us a series of experiments in this most useful art, continued for several years together, with accuracy and judgment, and related in a clear, distinct, manner. Theory alone can avail but little in Agriculture, which, as Dr. Home observes, "does not take its rise originally from reason, but from fact and experience. It is a branch of natural philosophy, and can only be improved from a knowledge of facts, as they happen in nature. It is by attending to these facts that the other branches of natural philosophy have been so much advanced during these two last ages. Medicine has attained its present perfection, only from the history of diseases and cases delivered down. Chymistry is now reduced to a regular system, by the means of experiments made either by chance or design. But where," continues he, "are the experiments in Agriculture to answer this purpose? When I look round for such, I can find few or none. There then lies the impediment in the way of Agriculture. Books in that art, we are not deficient in: but the book which we want, is a book of experiments."

After

After writing this, the Doctor read the three first volumes of Experiments, published by M. Duhamel, and gives them the following character *. "They are," says he, "distinct, exact, conclusive so far as they have gone, and stand a model for experiments in Agriculture. What a shame," adds he, "for Great Britain, where Agriculture is so much cultivated, to leave its exact value to be determined by foreigners!"

The 4th and 5th volumes of M. Duhamel's work, which contain the greatest part of the truly valuable experiments of M. de Chateau-vieux, deserve still higher commendation, and may yet more justly be proposed as models, not only for their accuracy and success, but also on account of the variety of plants which he has cultivated according to the principles of the new husbandry.

In these experiments, he has given many demonstrations of two facts of the greatest importance in Agriculture: viz. 1st, The manifest advantages of frequent and deep plowing, whereby the roots of plants may have a loose mould to extend themselves in, to a depth sufficient to secure them in moisture during the heat and drought of summer; and 2dly, That these plowings alone, especially where there is a strength of soil, are preferable to all manures whatever.

The late Reverend and worthy Dr. Stephen Hales, whose name will be a lasting honour to his country, and whose studies were constantly directed to the improvement of it, as well as to the general benefit of mankind; was pleased to give us leave to say, when the former edition of this book was published (M. Duhamel having previously sent him a copy of his work,) "that the English reader will find here many useful instructions and hints for farther improvements in husbandry;" and indeed, the reception this treatise has met with from the public, confirms the opinion of that truly patriot philosopher.

Some inaccuracies which had escaped the Editor in that former edition are corrected in this.

* In his Principles of Agriculture and Vegetation.

As

As M. Duhamel's five volumes were published in different years, he could not give an uninterrupted account of each experiment, from its beginning; especially as they were made by different persons, and in different places: nor could he well avoid frequently repeating, or, at least, resuming, the heads of what had been said before; by which means their progress towards perfection is not so obvious to the reader, as the writer of this work hopes they will appear, when ranged in the more methodical order he has endeavoured to give them. Another reason which has induced him to give each different experiment from its very beginning, is, that he might shew the difficulties which occurred at first, and how they were afterwards got over. He has translated only such experiments as seemed to him to carry with them a variety which may be instructive to his countrymen: and to render this work the more useful, he has given what appeared to him best in the modern practice of farming, either according to the old or new method. The plainness wherewith it is written, will shew, that his intention was to make it of as general use as possible.

Every one who contributes to the public good, deserves applause; and consequently it is due to all M. Duhamel's correspondents. But the obligations of the public, to the two gentlemen to whom we are indebted for most of the following experiments, are still increased, when we consider the unwearied diligence with which they pursued a subject of so different a nature from that of their respective employments. The post of Inspector-general of the Marine of France, would, alone, have given sufficient exercise to a genius less active than M. Duhamel's, and not allowed opportunity for his steady and successful application to this and every other branch of natural philosophy. 'Tis true, the necessary attendance on the discharge of his more immediate business, prevented him from pursuing his experiments in Agriculture, so far as he doubtless would otherwise have done, and from making them in that number and variety which the subject required: but we owe to his efforts and example, the zeal with which others have been animated in their experiments; and, above all, we are indebted to him for the excellent instructions we have received from M. de Chateau-vieux, who, even whilst he held the first Office in the City and Republic of Geneva, found time to apply himself with surprizing attention to this

this important object; and that too at an age which generally carries with it a dispensation from the cares and service of the public, to those who have less zeal for its real interest. The variety of his experiments, and the remarkably judicious observations which he makes upon them, shew him to be possessed of the most extensive knowledge of this subject.

Such are the laudable examples of two foreigners, for the advancement of Agriculture. The several Academies lately formed, and those which are now forming, in different Provinces of France and Switzerland, for the improvement of Husbandry and Commerce, shew the readiness of their countrymen to profit by and pursue their excellent plan; which we propose to ours, as highly deserving their serious attention. This kingdom has indeed already produced some instances of the same kind; but, unfortunately, the discoveries of many ingenious and intelligent men among us, discoveries often founded on actual experience, and therefore doubly valuable, are not sufficiently known, for want of a proper channel of public communication; the establishing of which, if rightly effected, could not but be attended with very great and lasting benefits. The late Lord Townshend thought Agriculture to be an object well worthy of his attention, and actually introduced the use of marle, and the husbandry now followed in the county of Norfolk, which, to this day, is greatly indebted to him for so valuable an improvement: and surely nothing could more become his Lordship, than thus to dignify his retirement, by making it useful to the public.

The misfortune is, that the success of these generous attempts of individuals, of whatever rank, is generally too much limited; often within the bounds of a county, or two at most: for the common farmer is perhaps the least inquisitive of any man, after improvements in his own business; is frequently the most obstinately attached to the practice of his predecessors; and often too, we must allow, it might not consist with prudence for him to risk his little competence, upon the success of experiments.

But we promise ourselves, that it will be the happiness of the present age to see every obstacle removed, which might retard a general improvement in Husbandry; the genuine and original source of the wealth

wealth and power of this Island, as well as of its ornament and security.

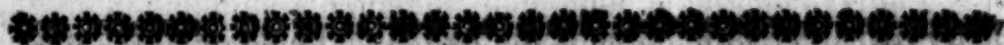
The Society for the encouragements of Arts, Manufactures, and Commerce, have taken This under Their peculiar care: and what may we not expect from a Society, the Members whereof are so well qualified to direct and improve the most useful inquiries; and who generously distribute their private bounties, to reward the labour, and indemnify the charge, of such experiments, as tend to promote any useful knowledge, or national advantage!

To return to the work before us. It is divided into four parts. The first contains the general principles of Agriculture, together with the most approved practice in the old husbandry; in which the reasoning of Mr. Evelyn is chiefly followed, as the most rational that has hitherto appeared, though undeservedly neglected by our writers on Agriculture. It is a misfortune to practical farmers, that his excellent *Discourse of Earth*, for want of having been oftener printed separate from his other works, has not been so well known to them, as a performance of that great merit deserves. Dr. Home's ingenious *Treatise on the Principles of Agriculture*, &c. deserves commendation; but it is not yet rendered sufficiently practical, to be of general use to farmers. The essential differences between the old and new husbandry, are pointed out and explained in this first part.

The second is confined to the culture of wheat, according to the principles of the new husbandry; the superior advantage of which is proved by a series of many experiments.

In the third part, the new husbandry is applied to the culture of other plants useful to the farmer.

That the description of the several instruments used in the new husbandry, might not interrupt the detail of the experiments, these descriptions are given in the fourth part, together with the Plates wherein those instruments are represented.



ADVERTISEMENT.

AS the French measures are retained in some few parts of this work, taken from M. Duhamel, (where the altering of them would have occasioned a multiplicity of fractions, perplexing, perhaps, to some husbandmen, without at all elucidating the experiments in which they are used; though they are in general, and always where it was necessary, reduced to the English standard, or it's equivalent,) it is proper to observe, that, supposing the English foot in *Guildhall* to be 1000 and the Paris foot in the *Chatelet* 1068, which is M. Greaves's calculation of their difference; the French *arpent*, consisting of 100 perches of 22 feet each, making in all 48400 square French feet, is equal to 51691 English square feet, or to 1 acre, 29 poles, 9 paces, 1 yard, and 2 1/2 square feet, that is to say, to very near an acre and three quarters of a rood English measure.

The French *bushe*, consisting of 4 *quarters*, and the quarter of 4 *litrons* of 36 Paris cubic inches each, contains 576 French cubic inches, which, in the above proportion, are equal to 615 1/8 English inches: and consequently the French *bushe* is to the English, as 615 1/8 to 2178, the number of cubic inches in the English *bushe*: or, in other words, it is equal to one peck, 1 quart, and nearly 2 cubic inches.

The French *bushe* for oats, is double that of any other grain.

The *Septier* contains 12 French *bushe*ls.

These may, perhaps, not be the exact mathematical proportions between the English and French measures, were their standard to be precisely ascertained, which it is not: but, at least, they are near enough to the proportions of the measures commonly used in both countries, to answer all the ends they are intended for in this work.

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PRACTICAL TREATISE
 OF
 HUSBANDRY.

PART I.

CHAPTER I.

OF ROOTS.



As the culture which is bestowed upon the pro-
 ductions of the earth, acts principally upon the
 roots, and relates more immediately to them,
 than to any other part of plants, we make them
 the subject of our first chapter. The nice di-
 stinctions by which botanists characterise certain
 kinds of plants, would be foreign to our purpose
 in this work, the sole design of which is to treat
 of Agriculture. We shall therefore content ourselves with dividing
 the roots of plants in general into two sorts, *viz. carrot or tap-*
roots,

roots, and creeping or fibrous-roots. The former, which are generally single, run down almost perpendicularly into the earth, and the latter branch out horizontally, whence they are likewise called *horizontal-roots.*

The Roots which proceed immediately from the seed, are always of the carrot or tap kind. Tap roots strike down perpendicularly into the earth, till it becomes too hard to admit of their farther passage: but when the soil is deep, and easily pierced, they penetrate sometimes to the depth of several yards, unless they are cut or broken, in which case they alter their direction. This is frequently observed; particularly in plants raised in water only. The tap-roots shoot out branches which extend horizontally; and these branches are stronger, in proportion as they are nearer to the surface of that depth of earth which is stirred by the plough or spade.

These are the roots which we call creeping, or fibrous. They extend sometimes to a considerable distance from the plant that produces them: but then they become so minute, that the naked eye can no longer trace them; especially when they have taken the tincture of the earth that surrounds them, as they generally do.

A Carrot, for example, which seems to have only one great root furnished with some fibres, pushes its roots, according to Mr. Tull, to a considerable distance: but they grow so very slender, that they cannot be distinguished from the earth that covers them, without great attention. The case is the same with almost all plants. To be convinced of this, and at the same time to know how far the roots of any plant can extend in ground that has been well loosened by the plough or spade, one need only make the following, or some other similar experiment.

Take a piece of ground that has not been broken up for a long time, and dig in it a triangular spot, 80 feet long, 12 feet wide at one end, and ending in a point at the other. Sow 20 turneps in the length of this spot, and let the earth round them be frequently dug and well hoed. When the turneps are come to their full growth, if that which is next the point is found to be the smallest, and the others are gradually bigger as they stand nearer to the part of the triangle, that is, for instance, four feet wide, it may be concluded that the roots of those bigger turneps have spread two feet on every side: and if the turneps are nearly of the same size from thence to the widest end of the triangle, it will be reasonable to suppose that their roots have not extended above two feet.

The following instances, says M. Duhamel, shew what effort trees will make, to find a proper soil for the extension of their roots.

On examining those of a hedge, at the side of which a ditch had been dug, it appeared, that after passing underneath the ditch, they re-ascended, and spread themselves in the plowed earth on the other side.

He made the same observation on a row of elms, which were very near being killed by the digging of a deep ditch pretty near them, in order to prevent their roots from damaging an adjacent piece of ground. The elms shot out fresh roots in the loose mould that dropt into the ditch: these roots re-ascended on the other side of the ditch, and spread in the plowed ground, and the elms soon recovered their former vigour.

He likewise observed, that on digging a trench at a small distance from a young elm, and filling it with good mould, the roots of that elm took their direction towards the trench, and grew to a great length in it.

He also gives an instance of two elms blown down by the wind, which had stood upwards of an hundred years, whose original roots, being planted too deep, had not increased in all that time, but the trees had been fed by other roots which shot out nearer the surface of the earth.

These observations prove that roots extend themselves to a great distance in the earth, especially when the mould is loose: and as a plant thrives in proportion to the extent of its roots, Mr. Tull justly infers the necessity of keeping the earth in a light state.

A root that has been cut or broken, never grows longer, but soon produces several new roots, all of which gather the proper food of the plant. Its means of subsistence are therefore increased by the breaking of its roots in digging or plowing.

CHAP. II.

Of LEAVES.

LEAVES are so necessary to plants, that few can subsist without them: for experience shews, that if they are strip'd of all their leaves, they generally die. I say generally, because we sometimes see trees strip'd by insects, which do not die. M. Duhamel mentions his having killed trees by taking off all their leaves. Is this difference, says he, owing to the insects destroying them by degrees,

or to my pulling them off all at once? Or is there any particular state of plants, in which this total stripping of them is, not of so fatal consequence?

The experiments of Mr. Mariotte, Dr. Woodward, and Dr. Hales, prove that the leaves are the organs of perspiration in plants, and that the greatest part of the sap goes off that way. The rest is spent in the increase of the plant. We likewise know that the leaves imbibe the moisture of rain and dew, which greatly promotes the growth of the plant.

In what manner leaves may be immediate organs of the perspiration of plants, or of the preparation of the sap, would be foreign to our purpose to inquire into: but that they are organs highly useful, appears from the following experiments.

If half, or two thirds of the leaves of a young tree in full sap are stript off, the tree loses its sap in two or three days. The bark, which before separated easily from the wood, then adheres closely to it. Before the leaves were stript off, the tree might be grafted by a scutcheon; but the next day, the bud cannot be inserted. The tree is therefore weakened by the loss of its leaves.

A willow, a poplar, an elm, that is suffered to grow without being lopped, will remain an age sound in the trunk: on the contrary, when turned to pollards, the trunk soon grows rotten. The repeated lopping of the branches is therefore very prejudicial.

The fine short grass which covers the lawns of England, is the only plant that can bear frequent close mowing or eating. This grows the more beautiful for it; but all others are killed thereby.

What we have said shews, that leaves, in whatever light they are considered, are of the greatest advantage to plants: and consequently that sain-foin, lucerne, clover, &c. are greatly hurt when they are fed too close by cattle, especially when young. We cannot therefore approve the practice of farmers, who turn in their flocks to feed on their wheat when it is too rank. This we shall have occasion to speak more fully of hereafter.

CH A P. III.

Of the Food of PLANTS.

SALT, air, fire, water, and earth, form, perhaps, the food of plants. But without entering into that detail, we may, with Mr. Tull, consider earth reduced to very minute particles, as the chief part

part of that food, seeing that plants become earth by putrefaction; and the other principles serve, perhaps, only to render earth fit for the nourishment of plants.

Salt, for example, may attenuate earth, water may enlarge its particles, and air and fire give it a due motion and activity: but earth seems to be the essential part. The plant would indeed die, if deprived of the other elements: but without earth, not even a skeleton of it would remain.

The earth we are speaking of, is not a simple elementary earth, or *caput mortuum*, but that compound substance called mould; for all the principles we have mentioned, may be extracted from the dead plants. It may hence be admitted, that earth is the principal food of plants: especially as it is known, that too great a quantity of salt renders earth barren, too much water drowns and rots plants, too much air dries up their roots, if exposed to it, and too much heat (or fire) burns them. But plants are not hurt by too much earth: for if a plant languishes when its roots are buried too deep, it ought not to be imputed to the quantity of earth that covers those roots, but to its not enjoying the moisture of the dew, the warmth of the sun, the influences of the air, &c.

But it is not the design of a Treatise of Agriculture, to enter into the discussion of so difficult a question as what is the real food of plants. We shall therefore, with Mr. Tull, consider earth greatly attenuated, as the immediate food of plants, without deciding whether it be simple, elementary, and void of all other substance.

Of whatever nature the substance which nourishes plants may be, we shall examine in the next chapter whether it be nearly the same for different kinds of plants.

C H A P. IV.

Whether the most different kinds of Plants draw the same sort of substance from the earth, for their Food.

IT is generally thought that each different species of plants is fed by different juices. The chief arguments for and against this opinion, are as follow:

1. It does not seem probable, say those who are for it, that the same homogeneous matter can be the food of so many plants, which differ so widely from each other in their shape, colour, taste, and properties.

To

To this it is answered; that there is no doubt but that the particles which plants appropriate to themselves, take different forms in each plant: but it does not at all follow, that they were not the same in the earth.

What would induce us to think them the same, is, that plants rob one another, if we may so say, of the nourishment that is in the earth. For, if a lettuce, for example, drew from the earth a food different from that of endive, a lettuce planted among endive would not only thrive better than if planted among other lettuce, but as well as if no other plant was near it: but we know by experience that this lettuce would thrive very poorly, and consequently that plants, tho' of different species, do hurt and rob one another.

To prove that the same juice takes different qualities in the vessels of the same plants, M. Duhamel mentions an experiment which he made long ago. He grafted a young lemon, of the size of a pea, by the stalk, upon the branch of an orange-tree. It grew there, ripened, and retained its quality of lemon, without partaking in any shape of that of the orange. The juices of the orange-tree must therefore have changed their nature at once, on their passing into the lemon.

2. As a second proof of this, he asks, why barley or oats is sown after wheat, but because the wheat has drained the earth of those juices only which are proper for its own species; and the juices proper for the nourishment of barley, or oats, still remain in the earth?

The answer is, 1. If barley grows well after wheat, for no other reason than because the earth has retained that kind of juice which is proper for its nourishment, it would follow that we might expect a good crop from wheat sown upon barley stubble, because the barley had not consumed the juices fit for the nourishment of wheat. Yet we may be sure the crop would be very bad; because wheat never thrives well, but upon land that is in fine tilth. If barley was to be sowed in land in as good condition, we should be more certain of an excellent crop. But as barley is less valuable than wheat, and does not require so loose a mould, it is sowed after only two plowings. 2. If each plant drew from the earth none but those juices which are proper to its species, why need the land be fallowed every third year? We need only sow wheat the first year, barley the second, oats the third, peas the fourth, and turneps the fifth;

so

so that if wheat were to be sown again, it would be on land that had rested five years from that kind of grain.

The most ignorant in farming will allow, that only poor crops will be obtained by such management; because all sorts of plants exhaust the earth: and besides, during the fallow, great pains is taken in plowing, by which means the earth is broken, the spaces between its particles are multiplied, and consequently it is rendered fit for producing plants which require a fine tilth, such as wheat, and is not exhausted by other productions.

In short, if each plant drew from the earth only the particular juice proper for itself, poppies, thistles, &c. which kill wheat, would do it no hurt. Wheat might, in that case, grow as well in a common, as in a well plowed field. Let it not be alledged, that the stalks of weeds are what hurt the wheat, and not the roots by the juices they consume; for if dry branches were to be set in such numbers as to make a greater shade than those weeds, they would not equally prejudice the growth of the wheat.

Those who think that every plant draws a particular juice from the earth, allow that the substances proper for the nourishment of each plant, ought to be dissolved in a quantity of water sufficient to convey them into the plant. But if weeds absorb all that water, none will remain for the nourishment of the plant which is cultivated.

An observation which seems of greater force than those yet mentioned, is, that a poor land, when rested, produces of itself a number of plants; and after having continued to feed those productions for years together, without any culture, it is still able to bear some good crops. The reason of this is said to be, that the plants which grow spontaneously upon that land, have not exhausted the substance which is necessary for the food of wheat.

It is likewise observed, that lands which have long borne sainfoin or lucerne, afterwards produce very fine wheat.

Answer. This observation seems to contradict the opinion of plants of different species, being nourished by the same kind of juices. But it is to be observed, 1. That lands are neither so speedily, nor so well improved by being rested, as by proper culture. 2. While land is rested, the rains, dews, and winds, lodge in it many particles fit for the nourishment of plants. The grass or weeds which grow on it afford food to cattle, which enrich the land with their dung; and the roots and leaves of the grass or weeds

weeds rot and add to its fertility. In such poor loose lands, these rich particles sink lower than the roots of common grass reach, and are thereby heaped up till the land is plowed, and then they become the food of wheat, &c. If tap-rooted grasses grow in it, their roots enrich the ground greatly when they putrify there; besides that such plants drop many of their leaves, which likewise rot, and by shading the earth, greatly mellow it.

Another observation which does not agree with the identity of food we have hitherto supposed, is, that maslin corn, which is a mixture of wheat and rye, succeeds in such light soils, better than wheat alone; and that a mixture of oats and vetches thrives very well, where oats alone would scarcely grow.

To this it may be answered, that those mixtures of wheat and rye, or oats and vetches, thrive better together, than wheat or oats would do alone, because the rye and vetches, being quick growers in such ground, shelter the wheat and oats from the scorching sun and drying winds, till they have attained sufficient strength to resist them.

From what has been said, M. Duhamel concludes;

1. That many plants of different species feed on nearly the same substance.
2. That there is no plant which does not rob those that are within its reach, of some part of their food.
3. That the soil which once is good for one kind of plant, will always be able to supply it with food, provided it be cultivated properly.

If these propositions are true, it follows that there is no necessity to change the species of plants from one year to another, on account of the different nourishment which the earth is supposed to yield them.

It cannot however be denied, but that, in following the common principles of agriculture, there is an advantage in sowing different plants successively in the same land. But this may be owing to three causes, very different from those to which we have opposed several objections.

The first, is the quantity of food which is necessary to some plants. The second, is the particular constitution of each plant; some being more tender than others.

The third, the degree of tillage which each plant requires.

All plants do not draw a like quantity of nourishment from the earth. A proof of this is, that there are poor light grounds which produce

produce rye, millet, and buck-wheat, but cannot produce wheat, or even oats.

On the other hand, there are plants whose roots can force their way into a very hard soil, which others cannot penetrate. For instance, I believe the roots of oats pierce a hard ground more easily than the roots of barley: for oats do tolerably well in stiff lands that has been plowed but once; whilst at least two plowings are necessary, in looser soils, to have a good crop of barley.

With regard to oats and barley, as they are not sown till spring, there is leisure enough to give them the necessary plowings: and the year of fallow affords sufficient time to give the land intended for wheat, the four plowings which are necessary for that grain.

If therefore you would always sow wheat in the same land, it must be sowed only every second year, and left fallow each intermediate year, in order to give it the necessary plowings. By this means, I believe, it would always produce good crops.

Mr. Tull relates a fact, which proves what we have just advanced. A farmer sowed a very rich piece of land with wheat, in the usual way. It grew so rank, that it lodged, and yielded but little grain. The owner, depending on the richness of his ground, plowed it but once, and sowed it again with wheat, in hopes that being less rank than the former, it would yield him a better crop. But it happened quite otherwise. His wheat came up so weak, that it scarce yielded the value of the seed. A manifest proof that wheat cannot do well in land that has not been sufficiently plowed.

Wheat thrives well after a crop of turneps: and no wonder; for turneps are sown in land in very fine tilth, and the earth is kept in a loose state while they are growing. By this means, the wheat is in land which has had more stirring than is usually bestowed upon it. Add to this, that as cattle are generally turned into the ground to feed upon the turneps, the land is well dunged by them.

Care should be taken not to sow wheat on land that has been under fain-foin: for the earth which has not been plowed for the nine or ten years that the fain-foin grew on it, cannot be brought to a sufficient tilth for wheat by one or two plowings. Wheat will grow very well after clover which has continued in the ground but one year. The land should be dunged, and plowed some time before it is sown. The clover leaves the ground in a loose state, and therefore fit for wheat.

Let us conclude then, that it is possible to have a good crop of
C wheat

wheat every year off the same land. All that is required to that end is, to plow oftener; to divide the particles of the earth sufficiently; to put the plants in condition to seek their necessary food; to hinder weeds from robbing the plants cultivated; and lastly, to raise no more plants in a field, than it can nourish properly. All these advantages are obtained by the new Husbandry.

CHAP. V.

Of the distribution of the Food of Plants within the Earth.

THE food of plants, of whatsoever nature it be, seems to be dispersed throughout every part of the earth: but it would lie useless there, if plants could not get at it. They must be able to extend their roots between the particles of the earth. Too stiff a soil, that is to say, a soil of which the particles lie too close together, hinders their extension. It is therefore necessary that there should be spaces between those particles, through which the roots may extend themselves. Most soils have, by nature, internal pores; but they are, in general, either too few in number; or not properly fitted to the roots.

If they are too few, there will often be a want of communication betwixt one pore and another; and the roots thereby impeded in their progress, will not be able to find the food necessary for the plant. This is the defect of too strong lands.

If the interstices are too great, the roots, passing through them without scarcely touching the earth, will draw little or no assistance from it: this is the defect of light lands.

Both these defects may be remedied by proper culture: for the earth contains so great a quantity of nutritive juices, that there is no danger of exhausting them. The only point is, to enable the roots to reap the benefit of them. It is still less to be feared, that this nourishing juice may dissipate or waste itself. Experience demonstrates that it cannot: for let earth be dried to ever so great a degree, let it be pulverised, and exposed to the sun, rain, and frost, it will only become the more fertile for it.

It is certain, that water should dissolve the particles destined for the food of plants; and that this vehicle is almost entirely dissipated by transpiration, after it has deposited in plants what is to be converted into their substances. But when water evaporates from the earth, without passing through plants, it does not carry the nutritive parts

off with it; since, as we before said, earth that is left to rest, instead of being exhausted, becomes more fruitful thereby.

To increase the fertility of land, there is not so much occasion to provide it with the substance which is to nourish plants, as to dispose it in such manner that the plants may, by their roots, collect and draw in those juices which almost all soils are abundantly stored with. To this end, the particles of the earth must be so divided as to leave an infinite number of small chasms between them, into which the roots may glide; so that, touching immediately the particles of the earth, they may draw the nutritive juices from them. This division of the earth may be effected by manures, and by tillage, as we shall shew in the following chapter.

C H A P. VI.

Of T I L L A G E.

THE more the particles of the earth are divided, the more its internal pores are multiplied: the more the surface of those particles is increased, the more the earth is enabled to furnish the food of plants; and consequently the more fruitful it is rendered.

This division may be effected two ways: by fermentation, that is, by mixing dung with the earth; or by breaking its parts mechanically, by tillage, whether it be with the spade, plough, or hoe, or any of the different instruments that have been invented to stir the earth.

It is much more profitable to increase the fruitfulness of land by tillage, than by dung. 1. Because only a certain quantity of dung can oftentimes be had, the produce of twenty acres being scarcely sufficient to dung one: whereas the particles of the earth may be divided and subdivided, *ad infinitum*. The benefit that can be procured from dung, is therefore limited; whereas no bounds can be set to the advantages which arise from tillage.

2. Most plants that are rear'd in lands much dunged, have not the fine flavour of those that grow in a good soil which has not been dung'd. Greens and fruits are seldom so good in the neighbourhood of great cities, where dung abounds, as in country gardens where it cannot be so lavishly bestowed. But nothing is more striking than the difference between wine produced by a vine that has not been dung'd at all, and that which is made from a vine that has been greatly dung'd.

Mr. Tull goes so far as to insinuate, that dung gives plants poisonous, or at least hurtful qualities: but his arguments seem to want weight. For example, when he says that venomous creatures are oftener found in dung than elsewhere, and mentions the toad as an instance of it; it may be affirmed that toads are not venomous: and if they were, is it not well known that hemlock frequently grows in gardens, close by a very wholesome plant? Besides, there is great reason to think that a plant which by its nature is poisonous, would be less so when raised in a well-dung'd ground, than if it had grown in a poor dry soil; by the same rule that selery acquires a stronger and higher flavour, in a poor, than in a well-dung'd soil.

3. Dung, which, according to Mr. Tull, acts by fermentation, causes indeed an internal division of the particles, which may be of great use: but the plough not only divides the particles, but changes their situation, by turning the earth upside down. The part which was exposed to the influences of the air and dews, takes the place of another part which is removed from underneath to the surface, and the earth that is turned up is penetrated by the rain and dew, and by the rays of the sun; all which greatly conduce to render it fertile.

4. Dung harbours insects, which afterwards feed upon the plants and spoil them. It is well known, that when lands are dunged, in which trees are planted, their roots are in great danger of being hurt by insects: and this is one of the chief reasons why florists banish dung from their gardens.*

5. It is true that dung is equally beneficial to light and to stiff grounds; but the same may be said of tillage; and the following is the manner in which Mr. Tull says this last acts upon both those kinds of land.

Too strong land is that of which the parts are so close, that roots cannot penetrate them without great difficulty. Now, if roots cannot extend themselves freely in the earth, they cannot draw from it the food of plants, which, for want of that food, will droop and languish.

* M. Duhamel invites all lovers of agriculture to try the following method, which he thinks may be attended with success.

Let a reserve of quick-lime be kept in a very dry place.

When you begin to make your dunghill, sprinkle each layer of dung with quick-lime, till the whole is finished. This kills most insects, and perhaps enriches the dung, and renders it more serviceable. This lime will likewise destroy the seeds of weeds which generally are in dung, and which hurt the wheat when they shoot up.

languish. But when those lands shall have been divided by tillage, when their particles shall have been so separated, that roots are at liberty to extend themselves and traverse all those small spaces, they will be able to supply the plants with their necessary food, and they will thrive apace.

Tillage is equally beneficial to light lands; but for a contrary reason. The fault of these lands, is their having too great spaces between their particles; and as most of those spaces have no communication one with another, the roots traversing the great cavities without touching the particles of the earth, draw consequently no nourishment from it. But when the particles have been broken by repeated plowings, the lesser intervals are multiplied at the expence of the greater: the roots have liberty to extend themselves, and they glide in, as it were, between the particles, meeting with a certain resistance which is necessary to their taking in their nutritive juice which the earth contains.

Mr. Evelyn, quoting Sir Hugh Platt, says, "that if you take a certain quantity of even the most barren earth you can find, reduce it to a fine powder, and expose it for a year to the vicissitudes and changes of the seasons, and influences of the heavens, it will acquire such a genuine and masculine pregnancy, within that period, as to be able to receive an exotic plant from the farthest Indies, and to cause all vegetables to prosper in the most exalted degree, and to bear their fruit as kindly with us, as they do in their natural climates." We are to suppose those exotics to have their due degrees of heat and moisture given them. To what shall we ascribe this great fertility? Most probably it is owing chiefly to the great division of the particles of the earth, and the multiplication of their surfaces. "By this toil, (*viz.* pulverizing the earth) adds he, 'tis found, that a soil may be so strangely altered from its former nature, as to render the harsh, and most uncivil clay, obsequious to the husbandman, and to bring forth roots and plants, which otherwise require the lightest and hollowest moulds."

What Mr. Evelyn says, does not, however, hold good with respect to every kind of earth: for M. Duhamel pulverised stiff clay, and sifted it through a pretty fine sieve; notwithstanding which, after it was well soaked with water, it became as close and compact as it was before he pounded and sifted it.

From this experiment it may be inferred, that dung is more necessary for clay lands than for any other, because it prevents the particles

particles reuniting after they have been divided by tillage: and it is observed, that clay is more benefited by fresh dung, than by what is rotted; because fresh dung keeps its particles more effectually from uniting, and, while putrifying, raises a warmth in the cold clay, and thereby divides its particles still more. But dung is not less necessary for light lands, which, as they contain few nutritive parts, stand in need of being supplied with them by dung.

This is nearly the substance of what may be said on the subject of dung, the usefulness of which cannot be denied, (as Mr. Tull seems to do) without contradicting the experience of every age and place.

But whatever advantage may be reaped from dung, by those who have the convenience of being plentifully provided with it, and that of correcting part of its defects by lime; it will not be the less true, that it is extremely beneficial to multiply the frequent plowings of the earth.

'Tis for this reason that lands intended to be sown with wheat, are plowed three or four times. Some farmers who have doubled the number of plowings, have found their lands more fertilised thereby, than if they had been greatly dunged. Three plowings extraordinary, do not cost half so much as one dunging. Thus an ill-judged œconomy becomes ruinous.

It follows from all this, that there is room for improvement in the culture of land. Plowing, as it is performed in some countries, for wheat, does not meliorate stiff lands. It only forms huge clods, which leave great cavities between them, by no means fit to supply plants with food. This must be allowed, after what has been said above. It is therefore absolutely necessary to break the clods thoroughly, and to reduce them to small particles, by plowing. The stiff land, then grown lighter, is in a state that suits the plants. Nothing more is wanting, but to keep it in that state by plowings made at proper seasons, as we shall explain hereafter, to prevent its returning to its former condition.

But what proves how beneficial it is in strong lands to facilitate the passages of the water, of the rays of the sun, and of the roots of plants, is, that their fertility is sometimes increased by mixing them with sand instead of dung. Sand itself affords no nourishment: but by preventing the particles from re-uniting, it produces the desired good effects.

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It does not appear, that light grounds require quite so many plowings. It might even be feared, least by frequent turning of such lands, and exposing their parts to the sun, they might be exhausted: for as the sun robs the light soil of its moisture, some of the more volatile particles, fit for the nourishment of plants, might be carried off with it: yet experience shews, that light lands are bettered by being plowed; either because the breaking and stirring of their particles renders them fitter to receive the moisture of rain and dew, to profit by the influences of the air, and be penetrated by the rays of the sun; or that, as Mr. Tull thinks, the internal pores are better fitted for the extension of roots; or again, because frequent plowings destroy weeds, which are more apt to grow in light grounds than in strong, especially when they are dunged.

To prove by an experiment, what we have just advanced with respect to light soils: let us suppose one half of a field to be indifferently plowed, and the other half to be plowed extremely well. Some time after, and in dry weather, let the whole field be cross-plowed. The land of that half of the field which was thoroughly plowed, will be of a darker colour than that of the other half which was but slightly plowed. This shews the benefit the land has received by plowing.

Some break the clods of earth with a roller. This is of great service when the land is not too wet, in order to prepare it for plowing. But if the earth is very moist, the roller will do it more hurt than good.

Others think to supply the want of plowing, by harrowing their land greatly after it has been sown. But this way of scratching the earth is of little service; and when it is moist, the horses poach and damage it considerably.

C H A P. VII.

Of the Management of Lands newly broke up.

WE shall treat in this chapter of lands which have not been sown of a long time, and which are to be fitted for wheat or other grain.

Such lands may be divided into four classes, viz. 1. Wood-lands, 2. Commons. 3. Pasture, or Meadow. 4. Marshy-lands. We shall speak of each of them separately.

I. *Of*

I. *Of Wood-lands.*

WOOD was formerly so common, that people did not take the trouble to cut it down. When they wanted to convert a piece of wood-land into arable, they set fire to the trees, and their ashes were thought to afford a considerable manure. But this operation did not exempt them from the labour of grubbing up the stumps and roots, and afterwards levelling the ground.

But timber is now so scarce, that great care is taken to preserve it. The stumps are grubbed up, and a profit is found even in digging up the roots.

The earth is so thoroughly stirred by digging up the stumps and roots, that one plowing in autumn is generally sufficient. The winter frosts kill the weeds, and break the clods; and after a second plowing in spring, these lands may be sown with expectation of an abundant crop: for the trees not having exhausted the earth towards the surface, but having on the contrary manured it with their leaves, a considerable produce may be expected for many years.

M. Duhamel mentions a small field, which had formerly been under wood. It produced plentiful crops of wheat and oats for upwards of twenty years together, without being rested. 'Tis true the soil was peculiarly adapted to wheat, and would have been exhausted much sooner if it had been a poorer earth.

II. *Of Heaths and Commons.*

BROOM, rushes, fern, heath, bushes, and briars, are the general produce of heaths and commons, which it is adviseable to burn, not only because their ashes enrich the earth, but likewise because the fire prevents their roots from shooting up anew, and destroys the greatest part of their seeds which would otherwise grow.

The fittest time for burning them is towards the end of summer, when the plants are withered. But great care must be taken that the fire extends no farther than is intended.

This care consists chiefly in clearing away all the grass on the side you would preserve from the flames, for a distance sufficient to prevent all communication. The grass that is cut down there, is spread upon the part intended to be burnt, and serves to kindle the fire, after it is dry.

Besides this precaution, a fair day must be chosen, when the wind does not blow high. By kindling the fire then on the side the wind blows from, you prevent its spreading farther that way, and

and see it remove gradually up into the heath or common. The fire should be carefully watched, for fear of accidents. If, notwithstanding these precautions, it should extend to places intended to be preserved, it may be stopt by water if any is at hand. But the most effectual way is to dig a trench: for by throwing up the earth on the side where the fire is, you cover the grass, and thereby hinder the further progress of the flames.

When the whole surface of the common is burnt, the roots of the different shrubs which are so strong as to stop the plough, are dug up with a pick-ax: and after the earth has been moistened by the autumnal rains, it is plowed into high ridges, with a strong plough, and with the help of a second plowing in spring, it may be sown with oats. The second year, it should have three thorough plowings; and the third year it will be fit to bear a good crop of wheat. But it must be by dint of plowing, that the fern, rushes, &c. are prevented from sprouting up again; for it is very difficult, tho' not impossible, entirely to destroy them. The winter plowings will kill the roots, by exposing them to frost; and the summer plowings, by exposing them to the heat of the sun.

In many countries, the method of burning is different, and less liable to accidents.

They cut down the broom, thorns, and other large plants, and sell them, or lay them in their farm-yards, or roads, to make dung. The stumps are then grubbed up, and laid in heaps intermixed with small twigs. These heaps are disposed in a quincunx form. The whole common is afterwards pared, and the turf dried. This operation rids the ground of all the young broom, and other remaining plants. The turf is laid upon the piles of roots in dry weather, and set on fire. The ashes are then spread, and the ground is plowed.

Mr. Worlidge advises using an instrument invented by Mr. Gabriel Platt, for stubbing up thorny shrubs, broom, goss, &c. as the easiest and least expensive way. This instrument is like a three-grained dung-fork, but much bigger and stronger: the stale thereof like a large and strong leaver. This being set about half a foot from the root of the shrub, is drove a good depth into it with a hedging-beetle. The stale is then elevated, and a weight, or fulciment, as he calls it, laid under it, after which it is pulled down with a rope fastened to the upper end, and wrenches up the whole bush by the roots.

III. *Of Meadows and Pasture-lands.*

THIS article comprehends sain-foin, lucerne, clover, and in general all grounds intended to be plowed, in order to their being sown. It likewise comprehends lands which are plowed only every eight or ten years, either because they are too poor to bear a crop every year, or because the country is not sufficiently inhabited for all its lands to be cultivated.

With respect to grass-lands of every kind, the farmer usually contents himself with plowing them well. But as ground which has rested a long time, is very hard, it is impossible to plow it till it has been softened by the autumnal rains.

This plowing, which must be performed with a strong plough, necessarily leaves the land very rough and full of large clods, which are mouldered by the winter's frost and rain; so that a second plowing, if the spring is not too wet, fits it for sowing oats. Wheat must not be sown in it, till, by frequent plowings, the earth has been brought to a sufficiently fine tilth for that grain, which requires more nourishment than oats.

Lands which are plowed only every eight or ten years, are commonly burnt, that the fire may divide their particles, and the ashes of the leaves and roots add to their fertility. As this process may properly be called a manure, we shall speak of it in the chapter of *Manures*.

IV. *Of moist Grounds.*

WE do not mean to treat here of the draining of marshes, but only to speak of such lands as, lying low, are overflowed with water from the neighbouring grounds; or of those, which, by their holding of water, are always so moist that they cannot be plowed.

In this case, if the land intended to be plowed, has any sort of declivity, it will be sufficient to surround it with a ditch, to receive the water from the neighbouring grounds, and likewise to carry off its own too great abundance of moisture. But if there be a bottom in the middle of this land, it will be necessary to drain it, by a ditch, which shall empty itself into the surrounding ditch.

When the ground is nearly level, our farmers cut deep furrows with a trenching-plough.

The land, being thus dried, is treated in one or other of the before mention'd methods.

C H A P. VIII.

Of M A N U R E S.

THE particular application of dung, we shall have occasion to mention hereafter. Like other composts, it acts by fermentation; crumbling and dividing the earth very much; and therefore it is of most service in the old husbandry, in which the earth is not so much pulverised by tillage, as in the new. The fermenting quality of dung, is chiefly owing to the salts wherewith it abounds: but a very little of these salts, says Mr. Tull, applied alone to a few roots of almost any plant, will kill it: so very fiery and acrimonious is their nature. This defect is in some degree remedied, either by keeping the dung till it grows mild, or by mixing it with the earth some time before the grain is sown. It is then of such service to most corn-fields, that little good can be done without it in the common husbandry.

Lime is frequently mixed with dung, and becomes an useful addition, not only as a manure, but as it prevents the dung's being a nest for insects, so much as it would otherwise be; and likewise helps to kill many of the seeds of weeds that are generally in it; tho' some, for example charlock-seeds, will remain unhurt for years together, amidst all the fermentation of a dunghill, and still retain their vegetative power; when at the same time that continued fermentation has been sufficient to destroy the power of the stercoraceous salts of the dung.

The action of the dung's ferment, is generally thought to afford a warmth to the infant plants, in their most tender stage, and the most rigorous season. But this advantage is greatly counter-balanced by the dung's letting water enter its hollows, and thereby becoming, in those parts, much colder in frost, than un-dung'd pulverised earth. As a confirmation of this, Mr. Tull says he has seen wheat-plants, in the winter, die, in the very spits of seemingly well-rotted dung; when un-dung'd drill'd wheat, close by, and planted at the same time, has flourished all the same winter.

By dung we mean only the excrements of animals, and what is usually collected in the offices and dung-yard, which is more or less useful in proportion to the quantity of salts contained in it.

The quantity of the food of vegetables made by tillage without dung, is beyond comparison greater than that made by dung with-

out tillage. This last reaches but little lower than the surface of the earth: the other extends to the whole depth of the staple.

Dung, without tillage, can do very little; with some tillage, it does something; with much tillage, it pulverises the soil in less time than tillage alone can do: but tillage alone, with more time, and *much less expence*, can pulverise it as well, and avoids all the inconveniencies of dung.

We cannot help joining with the author of the *new System of Agriculture*, in his severe censure on our country gentlemen, p. 114. "It is to me," says he "a surprizing proof of our gentlemen's inaptitude to this noble art, (agriculture) to see so many hundred thousand acres pestered, and corrupted, by *common dung*, the bowels of which very land are loaded with inexhaustible quantities of rich and wholesome physick for its own diseases. — *Dung* is not only prejudicial to some soils, but inferior to the worst of other composts, upon *any*. One would wonder to see, how people put themselves to extraordinary charges, and the inconvenience of sending to great distances for *horse-dung*, to manure those very lands which never fail of being verg'd, or bottom'd, by a substance of one kind or other, by far more proper for the end they aim at: And, therefore, I lay it down as a rule, almost without exception, that every soil, of what nature, situation, or condition soever, abounds with natural and sufficient *helps* for its peculiar imperfections."

It will be right to inquire next, what are the properties and uses of these natural manures, so much recommended by this author, and what soils they are suited to. To this end, we shall divide soils into three sorts, *viz.* clay, sand, and loam; and, in separate articles, propose the improvements of each.

I. Of Clay.

"*CLAY*," says Mr. Evelyn, p. 22, of his *Terra*, "is of all other a curst step-dame to almost all vegetation, as having few or no *meatus's* for the percolation of the alimential showers, or expansion of the roots; whether it be the voracious, hungry, weeping, or cold sort. In these cases *laxatives* are to be prescribed, such as drift *sand*, small *gritty gravel*, *saw-dust*, with *marl* or *chalk*, and continually vexing it with the spade or plow; but above all, with *sea-sand*, where it may be procured, and the burning of the ground to *ashes*, and all that it bears, the more
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“the better; for by no less severity will this ill-natur'd mould be subdued: *rotten-wood*, and the bottom of *bavine-stacks*, are good ingredients to this manure; and if it be a cold and wet sort, strewings of *foos* are good; if very stiff, rubbish of *brick*, *lime-stone*, and such trash, may properly be laid at the bottom, and on the upper part *composts* of *dung*.”

Rotten-wood, and *saw-dust* when rotted, says Mr. Miller too, is a very good manure for strong lands, because it loosens the parts of the earth, and renders it light.

Mr. Lisle, Vol. I. p. 26. advises, as a good way, “to tame harsh, churlish, obstinate clay, to fling it up in ridges in the winter, and after the first frost, when it thaws and molders, to fling and temper amongst it ashes or chalk, or whatsoever you have to qualify it: for the time being nickt, wherein you can catch the clayey corpuscles under the greatest disunion and separation, is the time for keeping them so, by mixing these other lighter bodies amongst them, which will the longest prevent them from their re-union.”

Sea-sand and shells are used to great advantage as a manure, in many places where they can be had without too much expence. Mr. Miller advises them chiefly for cold strong land, and loam inclining to clay. They separate the parts; and the salts which are contained in them, are a very great improvement of land. Coral, and such kind of stony plants which grow on the rocks, are filled with salts which are very beneficial to land. But as these bodies are hard, the improvement is not the first or second year after they are laid on the ground, because they require time to pulverise them before their salts can mix with the earth to impregnate it. The consequence of this is, that their manure is lasting. Sand, and the smaller kinds of sea-weeds, will enrich land for six or seven years; and shells, corals, and other hard bodies, will continue many years longer.

In some countries, at a great distance from the sea, great quantities of fossil-shells have been discovered, and used with success as manure: but they are not near so full of salts, as those shells which are taken from the sea-shore; and therefore the latter are always to be preferred.

Sea-sand is much used as manure in Cornwall, says Mr. Porlace in his Natural History of that county. The best is that which is intimately mixed with coral. In places where this excellent manure

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is found, it is taken up by a large bag of the strongest canvas, to the mouth of which is fitted an iron hoop or frame for keeping it open, and sinking it to the bottom of the sea, so as it may receive the sand and coral as it is dredged along by the barge-men. A barge-load is usually delivered for ten shillings, or less, if near the place of dredging: and where the land is good, a barge-load will dress an acre. It is used more for corn, than pasture grounds. It gives the heat of lime, and the fatness of oil, to the land it is laid upon. Being more solid than shells, it conveys a greater quantity of fermenting earth in equal space. Besides, it does not dissolve in the ground so soon as shells, but, decaying more gradually, continues longer to impart its warmth to the juices of the earth. It is chiefly found in Falmouth harbour, and the shores adjoining. Not only sea-sand is used as manure by every one who has it in his reach, but after storms they find the *alga marina*, *fucus*, *conserva*, or ore-weed, one of the best manures which nature affords, scattered in great plenty on the shore. Being a sub-marine plant, the wind and sun soon exhale its moisture: the sooner therefore it is taken from the shore, the better; and being spread on old and stiff earth, then covered with sand, it soon dissolves into a salt oily slime.

This is the most approved way of applying it. Some lay it naked and fresh from the sea, upon their barley lands, in the end of March and beginning of April, and have a good crop of corn: but the weeds grow so plentifully and rank afterwards, that no wholesome grass for pasture is to be expected for that year. Sir George M'Kenzie observes (Phil. Trans. No. 117.) that lands often used to this manure yield bad oats, and in a small quantity, the husks thicker than ordinary, and more darnel among the corn, than in lands which have not so much ore-weed laid upon them.

"The use of sand, as Mr. Miller observes, is to make the clayey earth fertile, and fit to feed vegetables, &c. for earth alone, we find, is liable to coalesce, and gather into a hard coherent mass, as is apparent in clay; and earth thus embodied, and, as it were, glued together, is no ways disposed to nourish vegetables: but if with such earth, sand, &c. i. e. hard crystals, which are not dissolvable in water, and still retain their figure, be intermixed, they will keep the pores of the earth open, and the earth itself loose and incompact, and by that means give room for the juices to ascend, and for plants to be nourished thereby."

"Thus, a vegetable, planted either in sand alone, or in a fat glebe,

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or earth alone, receives no growth or increment at all, but is either starved or suffocated: but mix the two, and the mass becomes fertile. In effect, by means of sand, the earth is rendered, in some manner, organical; pores and interstices being hereby maintained, something analogous to vessels, by which the juices may be conveyed, prepared, digested, circulated; and at length excreted, and thrown off into the roots of plants."

"Sea-sand," continues Mr. Miller, "is accounted a very good compost for stiff ground, for it effects the two things following; viz. It makes way for the tree or seed to root in stiff ground, and makes a fume to feed it."

Chalk, lime, rubbish of old houses, or, in short, whatever loosens the body of the clay, are good manures.

Shell-Marle, or any marle, which, dropt into vinegar, makes a strong effervescence, is a peculiarly good manure for clay: for, dissolving easily in water, it gives a freer passage to it, whereby the clay is kept dry even in winter; and if the clay is of a cold acid nature, the absorbent quality of the marle destroys that acidity, and keeps the clay warm. Many late experiments prove the truth of this; its effects being much beyond what could have been expected.

In very cold moist land, says Mr. Miller, I have frequently seen new horse-dung buried as it came from the stable, and always observed that the crops have succeeded better, than where the ground was dressed with very rotten dung.

Sheeps dung and deers dung are nearly of the same quality, and are esteemed by some the best of dungs for cold clays. Some recommend beating them into powder, and spreading them very thin over autumn or spring crops, about four or five loads to an acre, in the same manner that ashes, malt-dust, &c. are strewed. But these light dressings do not last long.

In Flanders, and other parts, they house their sheep at nights in places spread with clean sand, laid about five or six inches thick; which, being laid on fresh every night, is clear'd out once a week. This mixture of sand and dung, makes an excellent dressing for strong land; for the dung and urine of the sheep is a very rich manure. Mr. Quinteney thinks it the greatest promoter of fruitfulness in all sorts of ground. Others recommend hogs dung, as the fattest and most beneficial of any.

The dung of pigeons and poultry is especially good for cold, wet, clayey lands: but it ought to be dried before it be strewed, because

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it is naturally apt to clod in wet; and it should be mixed with earth or sand to keep it from clogging together, that it may be strewed thin, being naturally very hot and strong.

Human dung is another great improver of all cold sour lands, and especially if it be mixed with other earths or dungs to give it a fermentation.

But there is not any sort of manure equal to the cleansing of the streets of great cities, for all stubborn clayey soils, the parts of which will be better separated, and in a much less time, with this manure, than with any other compost whatever.

II. Of Sand.

BY the same rule that sand fertilises strong clayey grounds, clay meliorates light and sandy soils. But this manure can never have its due effect, unless it be well broken, and divided into such small particles as to be able to incorporate thoroughly with the light earth.

“Arenous and sandy earth,” says Mr. Evelyn, p. 19. wants ligature; and besides, consisting of sharp and asperous angles, it wounds and galls, curls and dwarfs our plants, without extraordinary help, to render the passages more slippery and easy: and therefore relenting *chalks*, or *chalk-marle*, is profitable, with *calcinations of turf*, or *sea-wrack*, where it is at hand: and if the soil be exceeding bibulous, spread a layer or couch of *loam*, discreetly mingled, at the bottom, to entertain the moisture.—Sand, being of an open and loose contexture, is apt to put forth a forward spring, as more easily admitting the solar rays: but it does not continue, and is an infirmity which may be remedied with *loam*, which not only unites it closer for the present, but is capable in time to alter and change its very nature also, so as too hot a *compost* be no ingredient with it.—If the soil be *sandy*, or other light mixed earth, imbody it with something of a fatter nature, as *marl*; and be sure so to stir and lay it (especially if with *loam*) that it may not sink too deep, and suddenly, as ’tis apt to do, and so desert the surface-mould, where it should do the feat, and therefore it is to be the oftener renewed.”

Dr. Lister divides the English sands into two classes: the first, sharp or red sand, consisting of small transparent pebbles, naturally found on the mountains, and not calcinable: the second, soft or smooth.

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Mr. Miller observes, that grounds which are sandy and gravelly, easily admit both of heat and moisture; but then they are liable to these inconveniencies, that they let them pass too soon, and so contract no ligature, or else retain them too long, especially where there is a clay bottom; and by that means they are either parched or chilled too much, and produce nothing but moss and cankerous infirmities; but if the sand happens to have a surface of good mould, and a bottom of gravel or loose stone, though it do not hold the water, it may produce a forward sweet grass; and though it may be subject to burn, yet it quickly recovers with the least rain.

Sand indeed is apt to push the plants that grow upon it, early in the spring, so as to make them germinate near a month sooner than those that grow upon clay; because the salts in the sand are at full liberty to be raised and put into motion; upon the least approach of the warmth of the sun: but then, as they are hasty, they are soon exhaled and lost.

Clay is an excellent manure, says the author of the *New System of Husbandry*, p. 124. and easy enough to be found in all places: but you must observe, 'tis only useful upon *sandy* grounds, or any lands of a nature entirely different from its own; among which you may reckon *gravelly* or *pebbly* soils. To these it brings the only part of excellence they naturally want, and consequently changes them, from what they were originally, to an equal fertility with the best and richest.

This will, perhaps, be strange news to many countrymen, who have bought *dung*, all their life-time, to destroy their land with. 'Tis as great a folly, adds our author, to *dung* grounds which require *cooling*, as 'twould be thought to administer *poison*, to cure a man of a *fever*. Our farmers are not sensible, that the *temper* of the *land* must, as necessarily, be consulted, as the *pulse* of the *patient*. The dunghil only is their universal refuge; they fly to *that* upon all occasions. They miss a crop, by dunging an improper soil; and lay on more dung, to remedy the misfortune.

Some few years ago, continues he, a friend of mine remarkably experienced the sufficiency of this observation. He had a couple of fields, divided by a hedge only; neither of which was fit for corn, or feeding. He resolved to improve them both: and when they were plowed up to that intent, he found, that one was a hard brown *clay*, and the other a very burning *gravel*. He was surprised to find these diametrical opposites such neighbours, and supposed that, for

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that reason, the hedge had been formerly made to separate them. He pulled down the division, and, having laid them open, set his men to work on trenching them six inches deep. The earth they dug out of one trench in one field, he made them carry instantly to another trench in the other field, in wheel-barrows; by this means interchangeably mingling the *gravel* with the *clay*, and the *clay* with the *gravel*.—When this was done, he had it plow'd all over with a deep cutting plow, and has sow'd it every season since with the richest grains. The effect of this is, that he has not now a finer or more mellow piece of ground in his estate. The very *nature* of the land is altered, and there remains no visible difference between the two divisions, but the whole is converted into a good *bazel-mould*, and produces a plump round corn, and as plentiful harvests as any soil in the kingdom.

The practice of the North-Riding of Yorkshire, as related by Dr. Lister, *Phil. Transact.* No. 225. shews to how great advantage clay is made use of there, as a manure. The clay is of a blueish colour, not sandy at all, but very ponderous. They dry it about Midsummer, on the declivity of a hill, and lay 100 loads on an acre of ground of a light sandy soil. They observe, that for three or four years it continues yet in clods upon the land; and that the first year, the land so manured bears rank ill-colour'd and broad-grain'd barley, but afterwards a plump round corn like wheat. This clay manuring will, by certain experience, last above forty years in the ground, and then it must be clayed again. This sandy ground, unless clayed, will bear nothing but rye, whatever other manure they use.

Clay becomes a much better manure when mixed with lime, than perhaps either of them are singly. The lime corrects the bad qualities of the clay, by rendering it more friable.

Sea-owse, that is, the settling of the tides on shores and level places, between low and high-water mark, is a manure of incomparable excellence for many sorts of lands; but is, on others, to be avoided, as a certain bane to whatever part 'tis mixed with. Loose sandy soils are peculiarly benefited by it.

The cleaning of ponds and ditches becomes likewise here an excellent manure, consisting of the putrified animal and vegetable bodies mixed with the rich earth deposited there by rains, &c. The same may be said of the mud in rivers, where, by the stagnating,

nating, or want of current in the water, the rich particles carried down by it have time to subside.

But of all the manures for sandy soils, none is so good as *marle*. There are many different kinds and colours of it, severally distinguished by many writers; but their virtue is the same; and they may all be used upon the same ground, without the smallest difference in their effect.

The colour is, either *red, brown, yellow, blue, grey, or mix'd*. It is to be known by its pure and un-compounded nature. There are many marks to distinguish it by; such as its breaking into little square bits; its falling easily to pieces, by the force of a blow, or upon being exposed to the sun, and the frost; its feeling fat and oily, and shining when 'tis dry. — But the most unerring way to judge of *marle*, and know it from any other substance, which may appear like it, is, to break a piece as big as a large nutmeg, and, when it is quite dry, drop it into a glass of clear water, where, if it be right, it will dissolve and crumble, as it were to dust, in a very little time, shooting up many sparkles to the surface of the water.

In many places, *marle* discovers itself to the most negligent eye; especially upon the sides of broken hills, or deep hollow roads, in most counties in England. Many rivers possess an inconceivable treasure, on both their sides, which is plunder'd by every flood. *Boggy lands* frequently cover it; and, in such, it seldom lies above three feet deep. 'Tis somewhat lower under stiff clays, and *marshy level grounds*. Most *sandy* lands abound in it, in their lowest places, at sometimes three feet depth, and sometimes seven, nine, or more. As for the *marle* itself, 'tis seldom you can find its depth; for, when the upper crust of the earth is once removed, all you can see, or dig, is *marle*, as deep as ever you can go. There are few, if any, instances of a *marle-pit's* being exhausted.

Nothing is more common, in most places, than to find the ditches which inclose a field, dug down so deep that they have penetrated six or seven inches into a bed of *marle* that lies under them, without the farmer's taking any notice of it, tho' the prodigious shooting and increase of the grass which is put forth by the *marle* thrown up upon the sides of the bank, might, one would think, be a means of discovering it. Where the *marle* is thus, by accident, disclosed, it not only turfs the sides and tops of the banks, and thereby secures them against all injuries of weather, but makes the grass grow to such surprizing length and thickness, that, when

beaten down by winds, it hangs along as if it thatch'd the earth which nourish'd it, and carries off the rain, without permitting any considerable quantity to enter through it.

The author of the *New System of Agriculture*, p. 118. recommends, as a very easy and infallible method of discovering whether there is any marle in places it may be thought to lie under, to have three augers made, of near an inch diameter, with an iron handle fix'd cross-wise to each; the bitts of these augers to be pretty large, and tenacious of what they pierce. One of them may be three feet long, the second six, and the third ten. When you would try the place you have hopes from, carry thither these augers, and let a servant take the first, and wring it into the earth, by twisting at each end of the handle. He must draw it out as often as it has pierced a new depth of six inches, to cleanse and examine the bitt, and observe what he draws up in it.—If you find nothing but common earth within the reach of this first auger, let him thrust the second down the hole which was made by the former, and proceed in the same manner, till he has wrung this also up to its handle; and then let him do the same by the third auger; always remembering to examine the auger bitt after each new progress of six inches.

By this means you will certainly, and without charge or hazard, discover not only what marle is under your soil, but whether any other thing of value lies concealed there, such as chalk, coals, fuller's earth, or quarries of stone, many of which are hid, and quite unthought of, in places where their value, was it known, is ten times more than that of the whole estate which covers them.

Our author relates on this occasion, a story of a Dutchman who was cast away upon the coast of Norfolk, and carried before a justice of peace, who, understanding that he had skill in *draining*, took him one morning into a field in which he had begun a work of that nature. The Dutchman perceived a whitish kind of earth, which had been cast out of one of the trenches, and examined it with more than ordinary earnestness. The justice asked him, if it were of any value in Holland? The sailor answered, that it was sold in his country at an extraordinary rate; that it came to Delft, and other places, down the Rhine, from a little village about twenty miles above Frankfort, and was used for making the finest sort of earthen-ware. The justice thereupon sent a sample of it to Holland, and finding the matter exactly as it had been represented, became a merchant of

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this product of his own land, and in a few years got ten thousand pounds by it.

Though, as was observed before, there is scarce any such thing as exhausting a marle-pit, there is however, now and then, an inconveniency attending such as dig too deep in level lands inclineable to wetness in the winter: for the springs will sometimes break in upon your pit, and much increase the labour of your workmen, and your own expences. There are little engines to be made, which, turning in a semi-circular frame, will catch the wind at every point, and, by the force of their motion, pump up vast quantities of water, and, by that means ease this inconvenience, which, however, had much better be prevented; and that may infallibly be done, by working wide and shallow, in such places as you suspect to be watry.

This author seems never to have seen shell-marle, by his not mentioning it. It is often found under moss, or that black earth usually dug up for fuel, or where there has been a bed of a river or running water; the shells in it having, probably, belonged formerly to some living creatures. Whoever finds this marle, finds a mine of great value. It is one of the best and most general manures in nature. It is proper for all soils, and peculiarly so for clay, as already observed. This effervesces strongly with all acids, which is perhaps chiefly owing to the shells. There are very good marles which show nothing of this effervescence: and therefore the above author judged right, in making its solution in water, the distinguishing mark.

The same writer, speaking of the quantity of manure proper to be laid upon light sandy soils, whether it be *chalk*, *marle*, *clay*, *sheep's dung* prepar'd with *earth*, not *sand*; *sea-owse*, of the closest, black, fat kind; *mud*, or the product of your *stercorary*; says, five and twenty load of the last is the quantity most proper for an acre; thirty of chalk; of marle, at least an hundred; and of clay, a little more: twenty load of sheep's dung, and as much of sea-owse; and, if you use mud, less than forty or fifty load will be too little. Whichever of these manures is used, care should be taken that the plowman turns it in, as fast as it is brought on, and spread upon the surface.

We cannot dismiss this article without mentioning an observation made by an ingenious gentleman, on reading Pliny's account (c. 6.) of the use of marle in Britain by the Romans. — It may be worth while to observe, says he, that Pliny is very particular on the state of

of agriculture in Britain in his days; and whoever will be at the pains to read what he says on that head, will have sufficient reason to think, that we are still far below the point to which the Romans had then brought it in this island: and this, I believe, cannot be said of any other art or science, which, like this, is independent of what is called genius, or of the powers of the imagination. In all others of this kind, we excel, not only our neighbours, but every nation that has gone before us; men of every rank and order lending a helping hand to forward and improve this art, or that science. But agriculture, which was the favourite employment of the greatest Roman senator, in his retreat from business, has (till of late) with us been left to the feeble efforts of the poor and illiterate peasant. What else, for example, but their gross ignorance and inattention, can account for the neglect of using marle in the improvement of particular soils? Pliny speaks of it as a particular species of improvement, which obtained in Britain and Gaul. He calls it the fat of the earth, and compares it to the glands in the human body, which are lapped in a coat of fat: as this practice (it would seem) was not used in Italy, it shews us how attentive the Romans were to agriculture, wherever they carried their arms; since, notwithstanding the continual alarms they lived in from the natives here and in Gaul, they found time to discover and perfect a species of improvement particularly suited to the soil and climate, and, of all others, the cheapest and most lasting.

We must farther observe, with Dr. Home, that there is a body very similar to marle in its appearance, but very different from it in its effects, and often found in the same bed with the best marle. It is of a darkish lead colour. Instead of fertilizing the ground, it renders the best soils incapable of bearing any kind of vegetables for many years. I have seen, says that gentleman, the spots on which it was laid, entirely barren three years after. I have heard of its bad effects continuing in other places for a much longer time; nor is it certainly known when they will cease. A body so very destructive to agriculture, deserves to be well characterised, in order to be shunned; and well examined, that we may know whence proceeds this noxious quality, and how to cure it when it has taken place.

Marle takes a smooth polish from the instruments with which it is wrought. A piece of this taken up, which has not been much exposed to the influence of the air, differs greatly in taste, from marle. Instead of the smooth unctuous taste of the latter, it is acid, and remarkably

markably astringent. It agrees with marle, in crumbling in water; but it differs remarkably from it, in raising no effervescence with acids, nor in the least destroying their acidity. It turns the syrup of violets red; which shews that it contains an acid: whereas marle, like all absorbent earth, gives it a green colour.

It appears from experiments made by the doctor, that this substance consists of an earthy body like clay, about one eighteenth part of salt of steel, and a small proportion of the vitriolic acid: and he concludes, that marle is the proper cure where this noxious earth has been inadvertently used, because it corrects the acid, and decomposes the salt.

III. *Of Loam.*

LOAM, being free from the too great stiffness of clay, and the too little cohesion of sand, in order to its due culture, seems only to stand in need of being kept in good tilth, and supplied at proper seasons with such substances as the experience of ages has shewn to contain in them matter fit for the nourishment of plants, or at least to be indued with the power of rendering the earth fruitful. Such substances we shall therefore call general manures. Of these, dungs of all kinds, putrid vegetable and animal substances, ashes of vegetables, and even of sea-coal and peat, soot, and lime, are the chief.

Dungs, as Mr. Miller observes, are designed to repair the decays of exhausted worn-out lands, and to cure the defects of land, which are as various in their qualities as the dungs are, that are used to meliorate and restore them. Some lands abound too much in coldness, moisture, and heaviness; others again are too light and dry; and so, to answer this, some dungs are hot and light, as that of sheep, horses, pigeons, &c. others again are fat and cooling, as that of oxen, cows, hogs, &c. And as the remedies that are to be used, must be contrary to the distempers they are to cure; so the dung of oxen, cows, and hogs, must be given to lean, dry, light earths, to make them fatter and closer; and hot and dry dungs to meliorate cold, moist, and heavy lands.

There are, continues he, two peculiar properties in dung: the one is to produce a certain sensible heat, capable of producing some considerable effect, which properties are seldom found but in the dung of horses and mules, while it is newly made, and a little moist: the other property of dung is, to fatten the earth, and render it more fruitful.

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The dung of horses and mules is an admirable fertilizer: but care must be taken not to lay too much of it on corn lands, because it produces abundance of straw.

Horse-dung, being of a very hot nature, is best for cold lands, and cow dung for hot lands; and being mixed together, may make a very good manure for most sorts of soils, and for some they may be mixed with earth.

The dung of pigeons and fowls is so rich, that it is generally used for a dressing to plants whilst they are growing. That of pigeons, says Mr. Miller, is the best superficial improvement that can be laid on meadow or corn land: but before it is used, it ought to have lain abroad out of the dove-house some time, that the air may have a little sweetened it, and mollified the fiery heat that is in these dungs.

The dung of poultry being hot and full of salts, tends much to facilitate vegetation: and is abundantly quicker in its operation, than the dung of animals which feed on herbs.

To animal substances belong all parts of their bodies, as flesh, blood, shavings of bones, hoofs, rags of their wool or hair, &c.

Mr. Evelyn says, the blood and flesh of animals is much more powerful for the enriching of land, than their dung and excrements, and is computed at twenty times the advantage; and to the same advance above this, is hair and calcined bones. Woollen rags are peculiarly useful for light soils. They should be chopt small, about an inch or two square, and scattered on the earth at the second plowing; for being thereby covered, they will begin to rot by seed time. They imbibe the moisture of dews and rain, and retain it long; and, as Dr. Home observes, thereby keep light soils in a moist state. The same may be said of the hoofs of cattle, when set upright in the earth, as Mr. Ellis directs. They hold the rain that drops into them, and it putrifies there, till, being worked out by succeeding showers, it falls upon the surrounding earth, and communicates a great fertility to it. —Sea-shells may likewise be included under this head: but we have already spoken of them, in the article *Clay*.

Vegetables afford great abundance of excellent manure. The custom of plowing in green succulent plants, is very ancient. All the Roman authors speak of it particularly. Buck wheat and vetches are the two plants most frequently sown in England for that purpose; and the time of plowing them in, is when they are in bloom, being then in their most succulent state. Some farmers plow in their second crop of clover, to enrich the land for wheat in the autumn.

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This should be done early enough to give the plants sufficient time to putrify thoroughly before the grain is sowed: otherwise it might prove prejudicial, by bringing on a heat which would hurt the corn. All kinds of sea-weeds are a most profitable manure to be plowed in.

Rotten vegetables of most sorts, says Mr. Miller, greatly enrich land: so that, where other manure is scarce, these may be used with great success. The weeds of ponds, lakes, or ditches, being dragged out before they seed, and laid on heaps to rot, will make excellent manure; as will most other sorts of weeds. But wherever any of these are employed, they should be cut down as soon as they begin to flower: for if they are suffered to stand until their seeds are ripe, the land will be filled with weeds, which cannot be destroyed in two or three years; nay, some kind of weeds, if they are permitted to stand so long as to form their seeds, will perfect them after they are cut down, which may be equally prejudicial to the land: therefore the surest way is to cut them down just as they begin to flower; at which time most sorts of vegetables are in their greatest vigour, being then stronger and fuller of juice, than when their seeds are farther advanced: so that at that time they abound most with salts, and therefore are more proper for the intended purpose. In rotting these vegetables, it will be proper to mix some earth, mud, or any other such like substances with them, to prevent their taking fire in their fermentation; which they are very apt to do, when they are laid in large heaps, without any other mixture to prevent it; and it will be proper to cover the heaps over with earth, mud, or dung, to detain the salts; otherwise many of the finer particles will evaporate in fermenting. When these vegetables are thoroughly rotted, they will form a solid mass, which will cut like butter, and be very full of oil, which will greatly enrich the land.

Another manure, greatly, and very properly recommended by this gentleman, is rotten tanner's bark. Oak-bark, says he, after the tanners have used it for tanning of leather, when laid in a heap, and rotted, is an excellent manure, especially for stiff cold land; in which one load of this manure will improve the ground more, and last longer, than two loads of the richest dungs. It is better for cold strong land, than for light hot ground, because it is of a warm nature, and will loosen and separate the earth; so that where this manure has been used three or four times, it hath made the land very loose, which before was strong, and not easy to be wrought. When this manure is laid on grass, it should be done soon after

Michaelmas, that the winter rains may wash it into the ground: for if it is laid on in the spring, it will burn the grass, and, instead of improving it, will greatly injure it for that season. Where it is used for corn land, it should be spread on the surface before the last plowing, that it may be turned down for the fibres of the corn to reach it in the spring; for if it lies too near the surface, it will forward the growth of corn in winter; but in the spring, when the nourishment is chiefly wanted to encourage the stems, it will be nearly consumed, and the corn will receive little advantage from it.

Ashes of all green vegetables contain an alkaline salt, of great use as a manure, but easily dissolved in water, and carried off. Greater care should therefore be taken to keep such ashes covered from the air, till used.

Peat-ashes are likewise of great service. We shall here give Mr. Ellis's account of this manure in his own words, vol. II. p. 68. "If barley, says he, is sown so late as the beginning of May, lean peat-ashes in particular may be applied over it, or harrowed in with the grain: but ashes burnt from fat black peat, such as they dig at Newbury, are of such a sulphurous nature, that they are afraid to lay them on their barley; and they do not dress their wheat with them till the spring is advanced, and then they are sown over it.—The great use of these ashes was found out about thirty (now fifty) years ago: but in a little time after they were brought into disreputation, by their imprudently laying on too many at a time, which burnt up the corn. Afterwards they found that six or ten bushels were sufficient to be sown over an acre of wheat, pease, turneps, clover, rape-seed, or saintfoine, as early as they conveniently could. But, as I said before, they are afraid to sow it over barley, lest a dry time should ensue, and burn it up; for these ashes are reckoned to contain three times as much sulphur in them, as there is in coal-ashes; and this they reasonably imagine from their great brimstone smell, sparkling and jumping, when they are stirred as they are burning, and drying up the corn by their too great heat. These peat-ashes, and likewise those from wood or coal, will help to keep off the slug from pease and other grains, by the salt and sulphur contained in them, and very much conduce to their preservation in cold wet seasons. But there is no such danger to be feared from the ashes of that peat, which grows as a turf over sandy bottoms, as great quantities do on Leighton-heath in Bedfordshire; for these are as much too lean, as the others are too rank."

Soot, either of vegetables or of coal, is reckoned a good improver of cold and moist grounds. Many find their account in strewing it early over their green wheat and barley: but Mr. Ellis says, neither of them ought by any means to be sooted after the 25th of April, because the wheat, and generally the barley, have then done gathering and branching, and are upon the spindle. He thinks it likewise proper to be sown over young turneps, that have all just appeared. Care should be taken not to strew it too thick; for otherwise its hot nature might hurt the plants.

Malt-dust is a good manure for poor clayey lands; and will oftentimes go farther than dung. It is most beneficial when rain falls upon it soon after its being strewed, and washes it into the earth before it has lost its strength. In some parts of Berkshire, they lay the malt-dust on at the same time that they sow their wheat, and harrow them both in together. This they find turn to good account. Some husbandmen hold it to be better for summer corn, than for wheat, and the reason they assign is, that the winter corn lies a whole year in the ground, and the malt dust will have spent its strength by the time the winter is over, and not hold up the corn in heart all the summer. They sow with the wheat two quarters of malt-dust to an acre, which makes four quarters of corn measure.

This manure is likewise a great improvement to cold grass-grounds.

All sorts of fern, straw, brake, stubble, rushes, thistles, leaves of trees, or any manner of vegetable trash whatever, says Mr. Worlidge, either cast into the yards amongst the cattle or swine, or cast into pools or places to rot in, or mixed with other soils, help very much, and make very good compost. The lees of wine, and the grounds and settlings of beer, ale, &c. have the same effect.

Chalk is a lasting manure for lands that it agrees with. Pliny tells us it was the custom of the Britons to chalk their lands, by which, says he, they received a great improvement, which lasted their lives.

It is a general saying, that chalking is better for the father than the son; but experience often shews it to be as good an improvement as dung, for twenty years together: and that clay land has been always the better for it.

There are several sorts of chalk: some of so hard and indissoluble a nature, that it is not fit to lay on lands simply as it is; but after it is burnt into *lime*, it becomes an excellent improver. Other sorts of chalk, more unctuous and soluble, being laid on lands crude as they are, and let lie till the frosts and rain shatter and dissolve them, prove

a very considerable advantage to barren lands.—Where any of these chalks are found, Mr. Worlidge advises proving their natures, by laying them on some small portion of land, crude as they are, or by burning them into lime, if fewel be plenty, or to half burn them; by which, says he, you may experimentally know the true effects and benefits that subject will yield.—And although, continues he, *chalk*, simply of itself, either burnt or unburnt, may not prove so advantageous as many have reported, yet it is of very great use to be mixed with earth and the dung of animals, by which may be made an admirable, sure, and naturally fruitful composition for almost any sort of lands; and it raiseth corn in abundance.

Chalk ought never to be plowed in, either too soon or too deep. It should have time to crack and waste on the surface of the earth, and not be turned down to the bottom of the furrow, let it should subside there in a mass, and not be stirred by subsequent plowings. Twelve or fourteen loads upon an acre will make some lands produce extraordinary crops of corn for fourteen or fifteen years together.—In the Isle of Wight, they sometimes lay twenty-five waggon loads of it on an acre. Their chalk is of a fat soapy kind, and they call it marle. The farmers in the hundreds of Essex bring their chalk as far as from Gravesend, but lay not half so much on an acre, as those of the Isle of Wight.—It should always be spread as soon as possible after it is dug, because it is apt to harden and grow stoney in the air.

Mr. Worlidge says, you may deal with chalky land as with clay land, though in a moderate way: for chalky land is naturally cold, and therefore requires warm applications. It is also sad, and will therefore the better bear with light composts; which is the reason that chalk is so great an improver of light, hot and dry grounds, especially after it has suffered a calcination.

If chalk be laid on clay, says Mr. Lisle, vol. I. p. 66. it will in time be lost, and the ground again return to its clay: and if clay be laid on chalk, in time the clay will be lost, and the ground return again to its chalky substance. Many people, continues he, think the land on which the other is laid for a manure, being predominant, converts the manure into its own soil: but I conceive in both cases the chalk and clay is, in time, filtrated through the land on which 'tis laid, and being soluble by rain into small corpuscles, is washed thro' the land on which 'tis laid; for neither of these manures is able to unite in its finest corpuscles, with the corpuscles of the land on which it

is laid, so as to make so strict an union and texture with it as the land doth with itself, and is therefore liable to be borne downwards with rains, till no sign of it be left.

Chalk, laid upon meadows, will enable them to give a great crop for three or four years, but it is thought afterwards to impoverish them. — Mr. Lisle is of opinion, that the contrary is the case with respect to pasture lands: because the grass being thereby greatly sweetened and increased, keeps constantly so much the more stock, by which it is maintained always in the same vigour.

The same gentleman assigns the following reasons, why chalk is good for sandy and clayey soils. “ I do suppose, says he, that chalk, laid on sandy or wood-seary ground laid up for pasture, may wash and sink in, and fill up the interstices, and thereby consolidate and mend the texture of such ground, and sweeten it, as it is a great alkali: and tho’ by time most of the chalk may be washed downwards, so that the ground may lose the virtue, yet I do suppose the strength of the ground may still continue much the better, by reason that such manure having made the sword of the grass come thicker and sweeter, the good pasturage on both accounts enlarges the quantity, and betters the quality of the dung the cattle leave on it, which in return maintains a better coat and surface to the ground: and as chalk fills up the vacuities of sandy or wood-seary ground, so on the contrary, it insinuates its particles into obstinate clayey and strong land, and divides it, by making in a manner a scissure, thereby hollowing and mellowing it; so that the two contrary extremes are cured by chalk.”

As loam may be inclined either to *clay* or *sand*, the husbandman may collect his manure accordingly, either of dry opening ingredients, such as ashes, lime, dung of sheep and horses, rubbish of old houses, &c. for the former; or of things which give cohesion and fatness, such as dung of cows and hogs, putrid animal and vegetable substances, marle, &c. for the latter.

Our farmers, collecting the manures they find necessary from time to time, as they come to hand, generally heap them together in what they call dung-hills. These dung-hills should be placed where there are no running waters or springs, that their rich juices may not be washed away. They are greatly negligent in this case. Mr. Evelyn, and the author of the *New System of Agriculture*, call these aggregates of composts *stercoraries*. Such should by no means have a communication with any of the offices, as advised by the latter; for the

the vapours arising from the putrid dung, must prove hurtful to the health of horses or other cattle exposed to it in a confined place. Mr. Evelyn disapproves of laying dung in heaps in the field, exposed to the sun, rain, and drying winds, whereby all its spirit and strength is carried away; and advises the following, as a better method of managing our dung-hills, or *stercoraries*.—Let the bottom or sides of a pit, says he, be about four feet deep, paved with small chalk or clay at the bottom, that it may hold water like a cistern: direct your channels and gutters about your house and stables to it. The pit must be under covert, so that the down-right rains may not fall into it. Lay a bed of dung in it a foot thick, on that a bed of fine mould, on that another bed of cyder-mere, rotten fruit, and garden offal, on this a couch of pigeons and poultry dung, with more litter, and beds of all variety of soil, and upon all this cast water plentifully from time to time.

The directions of the author of the *New System of Agriculture*, for making a *stercorary*, and which we much approve of, barring its being so near the stable as he seems to intend it, are as follow.

“Along the back of your stable cause a pit to be dug, to the depth of the foundation, or a pretty deal below it: let it be as long as the stable, but its breadth should be according to the quantity of dung you have conveniencies for making: let this pit be arch'd with brick, but very slightly, and an entrance left at one end, which may be shut up, or open'd, by a wooden door: let the sides and bottom be firmly lin'd with stone, and closely plaister'd over with a cement, which will by no means admit moisture.

Through the wall of this stable, and about a foot or more from the ground, let there be made square holes, which, opening into the *stercorary*, from within the stable, must be of sufficient largeness for the passage of the dung, that is from time to time to be shovell'd through them,

The stable floor should be made as smooth and hard as possible, that the urine of the horses may not soak into it, but descending from them to a little gutter, close along the wall, thence run through passages, which are purposely to be made, into the *stercorary*.

Pipes of earth, which cost but little, should be laid, from this place, to the cow-house, hog-sties, and privies, that all urine of man or beast, of any kind whatsoever, may immediately be convey'd
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to mingle with the other. Into which must be cast all ox dung, cow dung, hogs dung, and dung of fowls; all ashes, whether of wood, or sea-coal; the dust and sweepings of your yard and house; all weeds, old litter, rotten straw, and spare earth, which you can get; as also the washing of barrels, all soap suds, water which meat has been boil'd in, dish-water, and every such kind of thing, which is now thrown down the common sink, and render'd useless; and for the more convenient performance of all this, there may be left a pretty large square hole, in the outward declivity of the arch which covers the stercorary. This hole must have a wooden door fitted to it, which, lifting up and down, will, as occasion offers, not only serve for taking in the things above named, but, whenever more moisture may be thought wanting, it will admit as much as is convenient, by being left open in rainy weather, and, as soon as shut, forbid the entrance of any more. The other door, which I spoke of, in one of the ends, is only to serve for carrying out the dung, when it is to be made use of.

In such a stercorary as is here described, the charge is a trifle, not worth naming, in comparison with the profit. The dungs and other things, incorporating, and fermenting thus together, mellowed, and enriched by the spirit of the urine, and unimpaired by the sun, rain, or wind, attain an excellence, which is best known by the prodigious increase they make in your crops; and which proves demonstratively, that one load thus managed, is of more effect than twenty after the common manner."

We leave to experience to determine, whether a stercorary with only a shade thrown over it, would not nearly answer all the ends proposed by closing it up, and have none of the dangers attending the other.

The method of making *lime* is sufficiently known. Its use and application, as a manure, is all that appertains to our subject.

Liming of land, says the author of the *English Improver*, is of most excellent use; many barren parts of this kingdom being thereby brought to so fertile a condition for bearing most sorts of grain, that as good wheat, barley, and pease, as England yields, has, with the help of that manure properly distributed, been raised upon land, before not worth above a shilling or two an acre. He adds, that twelve or fourteen quarters will lime an acre. Another writer says 160 bushels. The difference of the land may require a different proportion.

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The most natural land for lime, says Mr. Worlidge, is the light and sandy; the next, mixt and gravelly: wet and cold gravel is not good, and cold clay is the worst of all.

A mixture of lime, earth, and dung, together, adds he, is a very excellent compost for land.

Mr. Evelyn advises, for land that wants heat, to mix *lime* with *turf* and *swartb*, laying them alternatively, turf on lime, and lime on turf, in heaps, for six months, by which means it will become so mellow, and rich in nitrous salts, as to dissolve and run like ashes, and carry a much more cherishing vigour, than if used alone in a greater quantity, and without danger of burning out and exhausting the vegetative virtue which it should preserve.

Lime, a little slack'd, continues he, is excellent for cold wet grounds and stiff clays, but it over-burns drier soils. It is the very destroyer of moss and rushes, as quick-lime is of furzes, being first extirpated.

Mr. Lisle thinks it is best, especially in lands that work mellow, to spread and plow the lime in as soon as it is slack'd, rather than to let it lie long covered with the earth in heaps.

Chalk-lime is not, in his opinion, so beneficial to land, as stone-lime; because a greater virtue must be attributed to the stone-lime for its burning quality after it is laid on.

Lime, being laid on meadows or pastures, slacks and cools by slow degrees, so as not to undergo such a heat and fermentation, as when it is covered with the hillocks of earth flung up in arable.

In Leicestershire, they sow or scatter the lime on wheat-land when they sow the wheat, but on barley-land the last earth but one; and so plow it in, lest, if they should sow it with the barley in the spring, it might burn it. They lay five quarters to an acre of each, according to the measure as it comes from the kiln; for after it is slack'd, those five quarters will make near ten.

In Shropshire, they lay dung and lime together, viz. about twenty load of dung, and only twenty bushels of lime on an acre.

Mr. Lisle gives it as a rule to all husbandmen, to be cautious of liming ground, and then plowing out the heart of it. I limed, says he, some years ago, in Wiltshire, seven acres for an experiment, and laid down one acre to its own natural grass in two years time, the grass of which is to this day 40 shillings an acre. The third year I laid down another acre, which is to this day worth 30 shillings per acre. The rest which I plowed five or six years farther, is not

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worth fifteen groats per acre. The like experience, adds he, I have had in burn-beaking ground.

We shall now give our author, Mr. Duhamel's account of liming, as practised in the Lower Normandy.

Lime is used there chiefly on fresh broke up lands. After having plowed them, not very deep, they lay on the lime in the following manner :

They carry on the lime as it comes from the kiln, and lay about one hundred pound weight in a heap on every square perch, so that the heaps lie at a perch distance from one another. Then they raise the earth all round the heaps, like so many basons : the earth that forms the sides of these basons, should be a foot thick : and lastly, they cover the heaps, half a foot thick, with earth, in form of a dome. The lime slacks under this covering of earth, and is reduced to powder : but then it increases in bulk, and cracks the covering of earth. If you do not carefully stop these cracks, the rain will get through them, and reduce the lime into a paste, which will not mix with the earth, or make a sort of mortar which will not answer the end proposed. The farmers are therefore very careful to examine the heaps from time to time, and stop the cracks. Some only press the top of the heaps with the back of a shovel : but this practice is subject to an inconvenience, for if the lime is in a paste within the heap, by this means you beat it so together that it will not easily mix with the earth ; for which reason it is better to stop the chinks by throwing some fresh earth over the heap.

When the lime is thoroughly slack'd, and reduced to powder, they cut the heaps with a shovel, and mix the lime as well as possible with the earth that covered it, and then, throwing it up in heaps again, leave it exposed to the air for six weeks or two months ; for then the rain will do it no harm.

About the month of June, they spread this mixture of lime and earth upon the land ; but not by throwing it about unequally, and at random : on the contrary, they take it up by shovelfuls, and distribute it in little heaps, at equal distances, on each perch of land : they observe that these little heaps promote vegetation, more than if it was spread uniformly all over the field, and they don't mind leaving small intervals unlimed between each shovelful. They afterwards plow the field, for the last time, very deep : then, towards the end of June, they sow buck-wheat, and cover it with the harrow ; and if any clods remain, they break them with a hoe.

Buck-wheat occupies the land about an hundred days; so that this grain sown about the end of June, is gathered about the end of September.

When the stalks and roots of this plant are dead and dried, they plow them up, and immediately sow wheat, and cover it with the harrow.

About the month of July or August, after the wheat crop, they plow as soon as possible: they plow for the last time in February or March, in order to sow oats, or in April for barley; but in this case they stir the land two or three times to make it fine.

They harrow in all these different grains, and when they are come up, they pass a roller over the oats, and if there remain any clods in the barley, they break them with a hoe.

The next February or March, they plow the land again, in order to sow it with grey peas or vetches.

After these pulse have been reaped, they give one or two plowings to prepare the land for wheat the ensuing autumn.

The year after, they sow oats, mix sometimes with a little clover, and then lay it down to pasture for three or four years.

In some new broke up lands they sow no buck-wheat, but let it lie fallow from the month of March, when it was first broken up, till October, when they sow it with wheat; making use of the intermediate time to give it several plowings: these lands being by this means much finer, they use little more than three-fourths of the quantity of lime above prescribed, and generally have a better crop than when they begin with buck-wheat.

Some farmers think a perch too great a distance for the convenience of spreading the lime; therefore they make the heaps less, and increase the number in proportion. Being persuaded that lime is most efficacious when it lies shallow in the ground, they first plow it in, and then give it a second plowing before they sow, which brings it again near the surface.

Others lay the lime in a ridge from one end of the field to the other; which makes it easier for them to spread.

Mr. Duhamel relates the following fact, as a farther instance of the use of lime-stone. "The stone which is used for building at Deneinvilliers, says he, is very hard, and bears polishing like marble. It is intermixed here and there with shells, some of which are filled with a kind of oker, and others contain a crystalline substance. These stones are fit to make lime of. Some workmen

“workmen who were building about our house, cut pieces of this
“stone upon a grass plot. When they had done their work, the
“rubbish was cleared away, and nothing left upon the grass but the
“dust and very small fragments which had fallen from the stones
“in cutting them. The next year, the grass grew surprisingly
“thick in all the places where these stones had been cut, was much
“taller and greener than any where else, and preserved its vigour
“for several years. One would scarce have thought that so hard a
“stone, reduced to powder, would have produced an effect like
“that of marle. The goodness of lime, as a manure, is, perhaps,
“chiefly owing to the fineness of the powder to which the lime-
“stones are reduced by calcination.”

Burning, or, as some call it, *burn-breaking* of land, may be reckoned among manures, because it is a very great improvement, and only practised upon some old pasture, or heathy, rushy, broomy, and such like barren grounds, which are considerably enriched by it; though, as the author of the *New System of Agriculture* justly remarks, lands so improved are, for want of one observation, generally ruined, in the common practice of plowing them three or four crops successively; by which means their whole fertility is most assuredly exhausted, and the soil becomes incapable of vegetation, though assisted by the richest dung, or other manure, in the world. Nothing but ten or fifteen years repose, will restore the abused vigour of nature; whereas, were these grounds strengthened by a little marle, chalk, or dung, between their first harvest and their second seeding, the improvement would be most complete and lasting. No method would be more easy; nothing possibly more advantageous.

The manner of burning land is generally known to be a paring off the fibrous turf, to a considerable depth, in a hot season, which being made into little hills, rais'd hollow, and at equal distances, are set on fire, as soon as they are dry enough to kindle, and so burnt to a kind of red ashes, and those ashes scatter'd over the whole surface: the ground is then plowed up very shallow, and the seed immediately sown.

This burning of ground is very costly, and not a little tedious, because the turf is raised in a laborious manner, by the force of a man's arms and bosom, pushing against a thing they call a *breast-plow*. — I will present you, continues our author, with a much neater invention, and which saves, at least, two thirds of the charge.

Let some smith in your neighbourhood, who is a ready workman, make a hollow plow-share, of a double form, that is, one which rises with a sharp edge in the middle, from the point to the top, and has a *fin* both ways; which fins must also begin at the point, and so run back to the share end. The dimensions of this share will be two feet broad, from the extreme points of the fins behind; one foot long, and a foot high, somewhat like a three-edg'd sword, if it were cut off a little above the point. The three fins, or edges, must be very well steel'd, and the whole made as thin, and as smooth, as you can get it done. — Into the hollow of this share must be fastened a light strong piece of ash, sharpen'd *forward*, to fit the bosom of the share, but *behind*, as square and sturdy as may be. Into this last part must be fix'd a strong piece of wood, like a *lever*, not perpendicular, but somewhat hanging backward. It must be about two feet high; and on the upper end, should have a cross staff, or other contrivance, to which must be fasten'd the harness of such cattle as your team consists of. The handles of the plough, and the *earth-boards* to turn the turf, are also fix'd into this square head; and there is no other instruction necessary for the use of this plow, but that, when you begin upon the edge of a field, and turn one turf to the hedge, and the other to the field, the last will cover one of the breadths you must take at your coming back, and the point of your share must, therefore, run close along the edge of this length of turf; by which means one side of your plough will raise two lengths, and, throwing back the highest, lay that uppermost, which had before lain under. By this one observation, you cannot miss the manner of plowing.

But, as this would only raise a long unwieldly *rope* of turf, which it would be necessary to cut into many hundred pieces, before it would be fit for *piling*, you will find the following invention of admirable use and expedition.

Chuse the body of a short thick tree; the heavier, and more solid, the better: let it be neatly rounded, and work'd into a *roller*, like those that are used for levelling barley lands. This roller must be hoop'd round, in six several places, each two feet distant from another: the hoops must be of strong iron, and nail'd very firmly on. — The middle part of every one of these hoops must rise into an edge, to about five or six inches above the level of the hoop itself: these edges must be very sharp, strong, and well steel'd, that the weight of the roller, as it goes round, may not fail to press them
all

all into the earth, as deep as they can go, and yet not damage them, either by blunting, bending, or breaking.

One horse will very well draw this roller, with which you must go over the ground you intend to burn, the contrary or cross way to that which you design to take with your plough, before described; which will by this means turn up the turf in pieces of two feet long, and one broad, the exact size they ought to be to form the little hills above named.—I have nothing to add upon this head, but, that those who practise it had need be careful how they *over-burn* the turf, which would, in that case, be robb'd of much of its fertility. A gentle fire, not flaming out, but mouldering inward, is the surest means of hitting the perfection of this work.

In like manner Mr. Worlidge cautions us against over-burning the turf; and the reason is, that, in the burning of any vegetable, a gentle, easy, and smothering fire, does not waste the volatile nitrous spirit so much as a quick fire would do, and causes more of it to fix and remain behind.

Mossy grounds are peculiarly benefited by being burnt. Where much long moss grows thick, says Mr. Lisle, tho' the ground be never so sandy in its nature, yet the ground underneath must be of a most cold and sour nature, by being kept from the sun, and the wet more fogging in it than if it had been solid earth upon it; for nothing retains moisture longer than such a spongy body, nor breaks the rays of the sun more from penetrating. Therefore such ground ought to be burn-beak'd; or the moss harrow'd up before seeding, and burnt in heaps; but rather burn-beak'd, to destroy the seeds of weeds.—If any do appear afterwards, the first year, it can be only some few that lay deeper in the earth than the fire went.

We shall conclude this article with M. Duhamel's account of burn-beaking in France.

With respect to lands which are plowed up but once in eight or ten years, it is the custom to burn them, in order that the fire may divide the particles of the earth, and that it may be fertilised by the ashes of the roots and leaves. This operation is performed thus.

They raise the surface with a hoe, or crooked pick-ax, the iron of which is very broad and thin, cutting each turf as regular as possible, about eight or ten inches square, and two or three inches thick.

As

As soon as these turfs are cut, they employ women to pile them, shelving one against another, with the grass side inward.

When the weather is fine, the air will dry them in a couple of days, sufficiently for making the furnaces and burning them: but if it should prove rainy, you must be careful to turn the turfs, for they must be thoroughly dried before you make the furnaces we are going to speak of.

In forming the furnaces, they begin with raising a sort of cylindric tower, of betwixt three and four feet diameter. As the walls of this little tower are made of the turfs, their size determines the thickness: but in building them they always lay the grass downwards; and they make a door, about a foot wide, on the windward side.

On the top of this door they lay a large piece of wood, which serves as a lintel. Then they fill all the inside with small dry wood mixt with straw; and finish the furnace by making a vault of the same turfs, like the top of an oven.

Before the vault is entirely finished, they light the wood that fills the furnace, and then immediately close up the door with turfs, and stop the opening that was left at the top of the vault; taking care to lay turfs on all the places where the smoke comes out too plentifully, just as the charcoal-makers do: for without that precaution, the wood will consume too fast, and the earth not be sufficiently burnt.

If you were to cover the furnaces with earth, all the crevices being too closely stopp'd, the fire would be extinguish'd: but by using only turfs, and always laying the grass downwards, there is air enough to keep the fire burning.

When all the furnaces are made, the field seems covered with little hay-cocks ranged in quincunx's: but you must watch the furnaces till the earth is red hot, to stop with turfs any cracks that may happen, to repair such as may be in danger of falling, and to light again such as may be extinguished. When the earth seems all on fire, they want no farther care: even rain itself, tho' before much be feared, will not hinder their being sufficiently burnt: so you have nothing more to do but to let them go out of themselves.

At the end of twenty-four or twenty-eight hours, when the fire is extinct, all the heaps are reduced to ashes, except some of the tops which will remain not sufficiently burnt, they not being enough exposed to the action of the fire: and 'tis for this reason that we advise

advise not to make the furnaces too big, because, the walls being proportionably thick, the outside of the turfs will not be done enough, when the inside is over-done: for if you burn them like bricks, they will not be fit for vegetation. Besides, in making large furnaces you will have too far to carry the turfs. You might even make them less, but that it would consume too much wood. It will therefore be found necessary to conform pretty nearly to the proportions we have prescribed.

When the furnaces are cooled, they wait till it rains, and then spread the burnt earth as even as possible, leaving none on the spots where the furnaces stood, which nevertheless will produce finer grain than the rest of the field; for which reason they leave only such turfs as are not burnt enough on those spots.

They immediately plow it very lightly, to begin to mix the burnt earth with the surface; but they go deeper in the following plowings.

If you can give the first plowing in June, and rain follows, it is possible to reap some advantage from the land immediately, by sowing turneps, radishes, or millet; which will not prevent your sowing wheat or rye the autumn following.

It is however best to lose the advantage of such a first crop, that you may have the whole time to prepare the land well for the reception of wheat.

Some chuse to sow rye rather than wheat, because the first production being very vigorous, wheat is more apt to be laid than rye.

Some do not spread the burnt earth till just before the last plowing for wheat. They content themselves with plowing well between the furnaces, which they take care to set exactly in a line, in order to leave a free passage for the plough. But this is a bad method: for, since wheat is always apt to be laid the first year after burning, it is better to spread the burnt earth early, before it loses part of its heat, and for the convenience of well preparing the land: for it is very material, that the burnt earth should be perfectly well mixt with the soil.

It must be owned that this method of burning is very expensive, because the labour must be performed by men, and that it consumes a great deal of wood: but it is very advantageous; for after this single operation, the land is better prepared than it would be by many plowings.

CHAP. IX.

OF PLOWING.

MR. Duhamel, in the first part of his eighth chapter, enters into a detail of the French method of plowing, which, not being so good as what is generally practised in this kingdom, we shall pass over, and give instead of it what appears to us the simplest and most rational practice here.

We join with the author of the *New System of Agriculture*, in thinking that there is no occasion for more ploughs than two; one for hard or heavy soils, and the other for light or mellow. There are, says he, in England, above an hundred different sorts of ploughs, and all bad. It is surprizing to see the toil and charge some people put themselves to, for want of a compleat knowledge in the make and management of this useful instrument.—I have seen, continues he, eight oxen tack'd to a plough, which the weakest beast in the team would have easily drawn in a much heavier soil.—He then distinguishes the only two ploughs he thinks worth using, by the names of the *strong* and the *light*.

The *strong* plough is to be used on all hard clays, stiff binding soils, and stony grounds, or any lands of that nature.—It is drawn by two oxen, nor are any more at any time necessary.—The following is his description of it:

Let the length of your share be a foot and a half; the point indifferently sharp, but very strong: let the shelving side be work'd thick, and without a *fin*, but steel'd all along its edge, from the point to the hinder part, where its perpendicular height must not exceed six inches.—The breadth must be just sufficient to carry a furrow seven or eight inches broad. In this plough, the place of the breast-board must be supplied by an iron plate, which, joining to the share, and being part of it, is, in a bellying manner, carried back, and gradually brought to *whelm*, as if it would fall upon the furrow. This plate, being made as thin as its use will permit, is supported by a pin from the plough-head, which is, in all respects, the same with that of the plough I before recommended for paring up the turf of lands to be burnt.—This breast-iron, with all the neatness and facility imaginable, takes the earth, as it rises on the share, and, without labouring under the load of a long

long furrow, turns it over as it runs along, and neither toils the oxen nor the driver.

One man is enough in all reason to manage this plough. He guides his oxen by a goad, as usual; and holds the handles with a great deal less fatigue than in other ploughs; for in this they are to be set at a large slope, and their ends standing wide from each other, they have the greater power over the going of the plough. If the share is apt to bite, or run too deep into the ground, his leaning a little harder than ordinary on the handles, will raise the point to what pitch he pleases; as, on the contrary, when he lays no stress upon them, the team will of course draw the point downward.

The *light* plough is properly to be used in sandy mellow grounds, and all such as are directly opposite to those for which the *strong* plough is recommended. It is drawn by two horses, with no manner of difficulty; or with one, if you please, for many have tried it.

The share of this plough is, in a manner, the share of the *turfing*-plough, divided into two equal parts. The share of the *light* plough shoves only one way, as not being double, and has a *breast-iron* exactly like that of the *strong* plough. In all other respects, it is the very same with the *turfing*-plough, even in dimensions, and therefore needs no farther description.

One man will hold and drive this plough, with more ease than the *strong* one, because the loads are more manageable. The reins, whereby he turns and checks the horses, pass through two long flits, one in each handle; and being just of length enough to hang down five inches, or more, they are prevented from being drawn back through the flits, by two pieces of wood, to which their extreme ends are fastened.

Our opinion with respect to ploughs is, that the best is that which is the most simple in its make and tackle; that requires the least strength to draw it, in proportion to the stiffness of the soil; and by the shape of the earth board, is best adapted to turn the turf, or furrow, up-side down. The wheel'd ploughs are too complex: the weight of the fore-carriage, and the friction of the wheels, greatly increase their draught. The compleatest plough is the Rotheram or patent plough. One man, with two horses, will do as much in a day with that plough, and in stiff land, as two men and six horses, can do in a moderately light soil with a wheel plough. — The principle of the Kentish plough, with a shifting mould-board, is very good, where the land is dry and will admit of it.

The anonymous author of the *New System of Agriculture* makes a very good and useful observation, which it may not be improper to insert here. 'Tis this: "When the land you are to plow, is the side of a very steep hill, as it often is, 'tis downright madness to proceed, as most countrymen do, by plowing directly up and down the *steep*. In this case, 'tis pity the driver is not in the place of his team: he would then, perhaps, discover, that 'twould be the wisest way to plow cross the hill, by which means, the cattle would not only draw with the same ease as if they work'd on plain ground, but the furrows, lying athwart, would prevent the rains from washing down the fatness of the soil, with every flood; a misfortune, to which, at present, all these lands are yearly liable, and often ruin'd, and impoverished by it."

Mr. Tull, for the same reason, advises plowing hills nearly horizontally: and, as a farther advantage, he observes, that their parting furrows, lying open, carry off the water, and by that means prevent it's soaking into the ridge next below.

We shall now give our former author's directions, as the best we know of in so small a compass, for the farther management of lands according to the old husbandry, which we have hitherto been chiefly speaking of.

Common and indifferent lands, says he, I distinguish into *heavy* and *light*, and comprehend, in this distinction, every particular difference of soil, which is known in this kingdom. All deep, hard clays, of what colour soever; all stiff, chalky, binding earths, and such, as after being exposed to the sun, or frost, grow hard and stony; with such as, in the violent heat of summer, chop and cleave upon their surface; all these I call *heavy* lands, not only because of the closeness and firmness of their nature, but as they all hang *heavily* on the labour of the plowman and his team.

On the other hand, all sandy, mouldering, gravelly, warm, mellow soils, all loose and open earths, of what nature soever; all such as are not sticky, but will presently dry after rain; and, instead of lying in huge clumps after plowing, are easily apt to dissolve, and crumble into mould, not being subject to bind by the heats in summer and frosts in winter; all grounds, of this kind, I distinguish by the name of *light* lands.

I shall take each of them from their first breaking up in the turf.

Let us suppose then, that, at Lady-day you begin your husbandry. The first thing necessary is, carefully and judiciously to observe

observe both the *surface* of your ground, and the *depth* of it. If you find it a good deep mould, and covered by a thick, strong, fibrous turf, such as by long lying, is become firmly rooted; in this case it will be much the wisest way to *burn* and spread the ashes, by the rules before given, not, by any means, omitting to manure, between the first *reaping* and the second *sowing*; after which you may proceed in all points, as if the turf had been plow'd in, instead of being burnt.

But if, on the contrary, you find your upper mould shallow, or thin turf'd, it will by no means be proper to burn it: you must, therefore, take notice, whether your soil be of the *light* kind or the *heavy*. If, upon examining it by the marks above-mention'd, you find it of a *heavy* nature, you must prepare your *strong* plough and ox team, and take care that, in the first breaking up, as they call it, your plowman turns the turf side neatly downwards, and lays his furrows so smooth and close together, that, at a little distance, a man can scarce see where the plough went.—If the strong turf is turned down in the latter end of autumn, the strong fibrous roots will be more effectually rotted against the summer plowing, and the soil will be mouldered, or mellowed, by the winter's frost and rains.

Between this first plowing and the second, is the only proper time for laying on your *manure* of what kind soever. The several sorts proper for lands of this nature, are *sea-sand*, *common-sand*, *sea-owse* of the lightest kind, not such as is black and greasy: *sheep's-dung*, mix'd with *sand* under a cover'd fold, as before described; or, for want of any of these, the *compost* in your *stercorary*.

Which ever of these you lie most convenient for, you may make use of, in the following proportions: of *sea-sand* you must lay upon every acre five and twenty loads; of *common-sand* never less than a hundred, which quantity you may double, if it lies commodiously: twenty load of *sea-owse* is sufficient; and fifteen of *sheep's-dung* mingled as before: and if you are obliged to rely upon the assistance of your *stercorary*, you must lay about twenty load upon an acre.

According to the manure you are obliged to use, your charge will be more or less considerable in the number of carts and teams necessary: for this rule you must be sure to observe punctually, that the *manure* be all laid on by the last day of July; in which time, the plowman, a labourer being employ'd to spread the manure, as

it is daily brought on, does, with the same plough he used before, give the second stirring to the ground, in order to turn in the richness of those helps you have bestowed upon it. By this means the sun, high and powerful in this season, will be prevented from exhaling the *virtue* of your manure, as it always does in the common way of letting it lie in little heaps in the field for a great while together.

It is now the time to harrow over your ground, with a heavy wide-tooth'd harrow, and a great weight laid upon it; by which means more mould will be rais'd, the clods broken into smaller pieces, and the manure mingled with the soil in every part. It is not enough to harrow once and away; — you must go over the same ground again and again, till you have made it as smooth and crumbly as is requisite: and this work will very well employ your team, from the end of July, to the middle of August: about which time should be begun the third and last plowing.

I come now to your lands of a *light* temper, and, for method's sake, will begin at Lady-day upon this land also. Here the *light* plough is to be used; and as to the turning down the turf, and laying smooth the furrows, the same care is to be observed on one land, as is recommended for the other.

Betwixt the *first* plowing and the *second*, these lands are also to receive the annual recruits which you think fit to give them; and that may be either *chalk*, *marle*, *clay*, *sheeps-dung*, prepar'd with *earth*, not *sand*; *sea-owse* of the closest, black, fat kind; all sorts of *mud*; or, for want of either of these, your *stercorary* may supply you.

Five and twenty load of the last is the quantity most proper; thirty of chalk; of marle, at least a hundred; and of a clay, a little more: twenty load of prepar'd sheeps-dung, and as much of sea-owse; and if you use mud, less than forty or fifty load will be too little. Use either of these manures as your best conveniency invites you, and, as was directed before, take care that your plowman turns it in as fast as it is brought on, and spread upon the surface.

But here comes a necessary caution, that your men begin to bring on the manure on that end of your hundred acres which your plowman first began to break up, that the turf may be rotted before it is turned up the second time. — Be careful of this rule, or you will find the neglect of it produce a great deal of confusion.

When the manure is all turned in, bring on your heavy harrows, and go over the land so often, as till the whole mass is exquisitely mingled,

mingled, and the mould becomes fine and dusty. You must be doubly careful in this operation upon your *light* lands, which ought, by the harrow, to be laid as smooth and level as a table.

About the beginning of August will come on your *seed-plowing*, properly so called upon these *light* lands, because you must here *plow* and *sow* together.

Authors give directions for plowing lands into many different forms, mostly arising from the different natures of soils, but too often from the particular long established custom of countries, without sufficiently entering into the reason of it.

Light soils are always plowed into broad lands, unless a very flat situation renders it necessary to plow into narrow stitches for wheat.

Strong soils are, without exception, advised to be plowed into narrow ridges.

It would be most adviseable, always to lay the ground level, and without ridges, where practicable. In summer fallowing, it might be used to great advantage even in clay lands.

In plowing wet land, for winter fallowing, I am not certain whether the best way would not be, instead of single bouts or narrow ridges, to make the ridges very broad, and lay them up high: for if the ground is level, the water will lie in the parting thoroughgs, and by soaking into the sides of the ridges, make it so poachy, as to render it very unfit to be worked, till late in the spring, unless the season is very dry; or, if there is much descent, great part of the best soil will be carried off.

We now return to Mr. Duhamel, who proceeds thus:

Mr. Tull says, the produce of the earth is increased by raising the ridges high, because the surface is thereby enlarged. As he insists greatly on this point, we cannot help mentioning his reasons, and those which induce us to differ from him.

He was sensible it would be objected to him, that the produce of a sloping surface is not greater than that of a plane equal in extent to the base of the slope: for the plants growing perpendicular to the horizontal base, there is no point of the slope, which does not answer vertically to a point of the horizontal base.

But he maintains, that the produce of the earth is in proportion to the inclined or sloping surface; because the roots have a greater extent of earth to draw their nourishment from; and because the ears of corn rising one above another, in the manner of an amphitheatre

theatre, are better enabled to receive the influences of the air, which certainly is of service to vegetables.

We shall not insist on the perpendicular growth of the stalks of plants, though we believe it real. But to shew Mr. Tull, how inconsiderable the advantage of what he recommends would be, we will suppose the furrows of a piece of ground plowed in broad-lands to be six inches deep, and the ridges six feet wide. The slope from the bottom of the furrow to the middle of each ridge will be one foot in six, which is considerable: but still the surface of the ridges will be to that of their horizontal base, only as 76 to 75. This is a small advantage, compared to a sixth of the ground, which is taken up by the furrows, and in which no corn is planted.

But, as in all this we consider lands only relatively to the common method of culture, it must be owned, that Mr. Tull might full as well not have entered into this question, which is quite foreign to the purpose in hand, since, even according to his own principles, it is best not to sow above one third of the surface of any land.

The design of tillage, is, to destroy weeds, and to reduce the earth to very small particles. The spade is very fit for these purposes, because, by turning the ground upside down, the weeds are covered with a quantity of earth, under which they rot. Besides, it stirs the mould eight or ten inches deep. But this operation is tedious, laborious, and expensive; so that it can be used only in gardens.

The plough is more expeditious; but, in general, it does not stir the earth so deep, and often turns it over in one great clod, without breaking it into pieces; for the coulter cuts the turf, the share which follows opens and raises it up, and the mould-board turns it over all in a lump.—Mr. Tull has endeavoured to improve this tillage; and to that end he has invented a plough with four coulters, instead of one. These coulters are placed in such a manner as to cut the earth which is to be opened by the share, into slips of two inches breadth; so that when the plough opens a furrow of seven or eight inches wide, the mould-board turns over a well divided earth, which does not fall in large clods, as after the common plough. The consequence of this is, that, on a second plowing, the plough turns up an earth already considerably broken, instead of meeting with clods, and even turf, which, having taken fresh root since the former plowing, is as difficult to break, as if the earth had never been plowed.

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We fear that the great disadvantage attending the use of this plough may be, that the resistance occasioned by the three additional coulter's may be such as to require a greater number of horses than the increased profit can afford.

Mr. Tull says farther, that his new plough can stir the earth ten, twelve, or fourteen inches deep; and as this plough makes deep furrows and very high ridges, a larger surface of the earth is exposed to the influences of the air.

When a field is intended to be broke up, which has not been plowed of a long time, the earth should be very moist, especially if it be a stiff land; for otherwise it would be so hard, that the coulter would not be able to cut it, nor the share to turn it up. But when lands are in tilth, care must be taken not to plow them when over wet; because the trampling of the horses and the share itself will poach and as it were knead strong lands, almost equal to what potters do when they prepare their clay for use; and thus the land is damaged, instead of being improved.

Mr. Tull recommends putting all the horses length-ways, when a soft ground is plowed; that, by their treading all in the furrow, the earth may be less poached.

If the land is in good tilth, it may be plowed in dry weather: but the best time is when it has been a little moisten'd by rain, especially for the new plough, which would not easily go deep, if the earth was very dry.

'Tis true that as the four-coulter'd plough enters deep, and turns up a great deal of earth, a greater strength is required to draw it; so that it will be necessary to use three horses instead of two, and four instead of three. But the excellence of this tillage will make ample amends for that additional expence.

The four-coulter'd plough is used only for the first plowings, to break up fresh grounds, or give a good tilth to those that have not been plowed before, or that have been ill plowed for a long time. It is likewise very fit for winter plowings; and Mr. Tull uses it sometimes to make deep furrows in the middle of the alleys between the rows of corn.

But he does not pretend that all plowings should be made with this plough. He approves of the common plough for the summer plowings, tho' he generally employs for that use a lighter plough with one coulter, and without any wheels, which he calls the *horse-boe*; because he performs with this, what bears some
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resemblance to the common hoeing. 'Tis chiefly with this that he plows the alleys, or cultivates plants while they are growing.

Mr. Tull has not only contrived instruments to bring the earth to a proper tilth, and others to preserve it so; but, convinced that in the common method of sowing, the seed is neither distributed equally, nor buried at the proper depth each kind of seed requires, he has likewise invented a *sower*, or what he calls a *drill-plough*, which makes the furrows, drops each grain at its proper depth and distance, and, filling up the furrow again, covers the seed. — As this instrument does not seem to us sufficiently complete, we shall give, in the last part of this work, descriptions of other *sowers*, which we think preferable to his.

C H A P. X.

Of the advantage of cultivating annual Plants while they grow, as the Vine and other perennial Plants are cultivated.

THE earth is generally prepared to fit it for receiving the seeds of annual plants; after which, some few leguminous plants excepted, they are left to shift for themselves, till they have yielded that part for which they are cultivated.

But we propose tilling the earth during the growth of annual plants, as is done with the vine and other perennials in different seasons of the year.

This proposition is a natural consequence of what we have said before: for as we have shewn that tillage is of very great service to plants, it is proper to make use of it when they are in most need of food. Though land be never so well tilled in autumn, it hardens or saddens in the winter; its particles approach one another; weeds spring up, which rob the useful plants of their nourishment; and at the end of the winter, the ground is in nearly the same condition as if it had not been plowed at all. Yet it is at this season that plants ought to shoot with the greatest vigour. They consequently now stand more in need of the plough, to destroy weeds, to lay fresh earth to their roots in the room of that which they have exhausted, to break the particles of the earth anew, to enable the roots to extend themselves, and gather that ample provision of food of which they at this time stand in the greatest need.

In the common husbandry, the whole attention is to provide a great store of nourishment for wheat, at a time when it scarce con-

times any, as it then produces only a few leaves. But when the winter rains, and the first drying heat of the spring, have rendered the earth almost as hard as if it had never been plowed, the wheat is abandoned to itself, at a time when it might, and ought to be, assisted by proper culture.

Our farmers, in this, act as preposterously, as it would be to give a child a great deal of food, and diminish it gradually as he grows bigger.

The great advantage of having land in fine tilth before it is sowed, is universally allowed: but we must not stop at these first preparations. Plants require a due culture whilst they grow, and must not be abandoned till they come to their full maturity.

Some garden plants acquire great strength by being transplanted; because, after having been confined in the nursery, they are put into large beds, where they find a new and loose mould. The plants of corn may be equally benefited by the plowings which Mr. Tull proposes, that is to say, by stirring the earth near them. If any of their roots are displaced or broke, the plant does not suffer by it, because it shoots out several instead of one; and most of the roots not having been displaced or hurt, they continue to supply the plant with nourishment, till the displaced or broken roots have taken fresh hold of the earth; and then the plant becomes more vigorous than before: for it is found by experience, that when a root is cut, it fails not to shoot out several new ones, which are more proper to draw nourishment from the earth. The breaking of a root is therefore a means of multiplying the mouths, or rather suckers, which collect the nourishment of plants.

Those who are against these frequent plowings, are afraid of drying the earth too much; because, say they, the moisture escapes with greater difficulty from a hard earth, than from that which has been well stirred by plowing.

In answer to this, it will appear from many of the following experiments, that, even in the driest weather, land cultivated according to the new husbandry continues constantly moister than that which is managed in the old way. The reason is assigned by Mr. Elliot of New England, as follows, in a most laudable attempt of a periodical publication, called *Essays on Field Husbandry*. "This method of repeated plowings, says he, fits and prepares the land to receive and retain all the benefits of the atmosphere. When land is made fine to a good depth, it is prepared with
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“ open mouth to drink in and retain the dew. When the dew
“ falls upon land that is untilled, the ground being hard, it does
“ not sink deep, so that the next day's sun carries it off again. It is
“ the same thing if the land be too light and loose. There is not
“ a sufficient connection of parts to convey the dew from one particle of earth to another.”

The Indian corn which is sown in the best plowed land, and is afterwards hoed, always bears drought better than other grain, because the land is prepared to receive and retain the dew. Mr. Evelyn made the following experiment: He dug a hole in the ground a good depth, reduced the earth to fine powder, and filled up the hole with it. A drought came on; the powder'd earth was moist to the bottom, when the adjoining land was exceeding hard and dry.

If several rows of wheat are sown in a poor but well plowed land, the blades of the corn will turn yellow in spring, especially in dry weather. If the ground bordering upon these rows be plowed deep, in some places near, and in others at a considerable distance from the rows, the corn will recover its verdure first in the places that are nearest to the new plowed ground, and afterwards gradually in the others, according to their distance; which proves that the wheat recovers its verdure, in proportion as its roots reach the loose earth. This holds equally true in all plants: for Mr. Tull affirms, that he never saw a plant in a languishing state, when the surrounding earth has been well plowed; and that, on the contrary, he has seen plants so situated, grow to a prodigious size. He instances, amongst others, a stalk of mustard, which grew so high that a man of a common size could not reach the top of it with his hand.

In short, stirring the earth about plants while they are growing, is so useful, that in some parts of Berkshire, and in some districts of the Gatinois, they hand-hoe their wheat; and tho' this operation is expensive, it is affirmed that the crops amply repay all the charge and trouble. How much more profitable would it be if this labour could be done at a less expence? The methods proposed in the following chapter, will shew that it may.

C H A P. XI.

General description of the drill and horse-hoeing Husbandry, for the culture of annual Plants.

AS we shall hereafter give a particular description of the chief instruments used in this new husbandry, it may suffice to say at present, for the better understanding of what follows, that the drill, which is drawn by one or two horses, forms furrows of what depth, and at what distance is desired, drops into the furrow the exact quantity of seed thought proper, and immediately covers it.

We shall now examine the three following questions, each of them in a separate article, *viz.* 1. At what depth the seed ought to be sown: 2. The quantity of seed proper to be sown: and, 3. The distance at which the rows should be placed.

ARTICLE I.

At what Depth the Seed ought to be sown.

THE seeds of all plants should not be sown at the same depth. To satisfy myself of this, says M. Duhamel, I dug a trench twelve feet long, sloping it gradually from the surface at one end, to the depth of two feet at the other. I sowed different seeds in this trench; and having put the earth in its place, I observed, 1. That hardly any seeds rise when buried deeper than nine inches: 2. That some seeds rise extremely well at the depth of six inches: 3. That other seeds do not rise at all when they are above one or two inches deep. Experience shews, that the same seeds may be buried deeper in a light, than in a heavier soil; and that seeds which lie too deep in the earth to spring up in a dry year, may rise in a warm moist year. Experience likewise teaches, that seeds which are buried too deep in the earth, will remain there ten or twenty years sound and unaltered; so that if by moving that earth they chance to be brought to the surface, they grow extremely well, and produce their proper plant.

It appears from hence, that each kind of grain should be sown at its proper depth, which is best known by experience. Mr. Tull therefore proposes having twelve gauges or sticks, to be used as follows. Bore a hole in one at the distance of half an inch from the end, in the second at an inch, and so on, increasing half an inch to

each of the twelve. Drive a peg into each of these holes: then, in that sort of ground where you intend to plant, make a row of twenty holes with the half-inch gauge, put therein twenty good seeds, cover them up, and stick the gauge at the end of that row; then do the like with all the other eleven gauges: this will determine the depth at which the most seeds will come up, and the drill must be set accordingly.

ARTICLE II.

Of the quantity of Seed proper to be sown.

IT frequently happens in sowing by hand, that one handful is larger than another; that the grains being smaller, the sower takes a greater number of them into his hand. If the field is rough and full of clods, the greatest part of the seed is collected in the hollows, whilst but little remains on the higher parts. By this means the seed is distributed very unequally.

Besides, too much seed is employed in the common way of sowing: because, as it is buried at different depths, what is buried too deep, does not rise at all; whilst that which remains uncovered, is eat by birds.

These inconveniencies are prevented by the drill. For, 1. It makes the furrows at any distance you please, and at whatever depth experience hath shewn to be most proper for the seed that is sown. 2. As the drill fills all the furrows with earth, none of the grain remains uncovered. 3. The drill drops into each furrow the exact quantity of seed that is found to be most proper.

Every seed is therefore placed so properly in the earth, by means of the drill, that we may depend they will all do well, unless they are hurt by insects.

But as the drill sows only the quantity of seed that is absolutely necessary, one ought to be certain of the growth of every grain; because it often happens, that part of the seed is imperfect, and does not sprout at all. As the eye cannot distinguish its quality, we should assure ourselves of it by experiment, by sowing fifty or an hundred grains taken by chance, but exactly numbred; and, when they spring up, the number of plants will shew whether a tenth, a sixth, or a third part be deficient, and the quantity of that which is sown should be increased accordingly.

It is farther proposed to sow the seeds in rows. These rows should be single, double, triple, or quadruple, according to the different

different kind of plant intended to be cultivated, as we shall shew hereafter. A space of seven or eight inches, which Mr. Tull calls *partition*, is left between these rows. The space occupied by the rows, we shall, with gardeners, call the *bed*; and the large intervals between the beds, we shall call *alleys*.

We have shewn that the drill ought to distribute more or less seed in the rows, according to the nature of each plant. To know the space that should be left between the seeds in the rows, it is necessary to observe how much ground a strong and vigorous plant of each kind takes up, that the drill may be set so as to drop each grain, at the distance that a very thriving plant requires: for we may be assured that all the plants will arrive at their greatest perfection, when cultivated according to the new husbandry.

ARTICLE III.

Of the distance at which the rows should be sown.

WHAT may at first sight seem to be a considerable objection against the new husbandry, is, the width of the alleys or spaces between the beds. Many will be surpris'd that so much land should lie, as they think, lost. But a trial of the new method will soon remove this prejudice.

At harvest, it will be found that most of the grains of wheat have produced twenty or thirty stalks a-piece; whereas, in the common husbandry, they seldom exceed two or three. If it were possible to distribute each of those twenty or thirty stalks in the alleys, the earth would appear as well covered as when the whole is sown in the usual broad-cast way. But as the ears are likewise larger, and filled with better grain, it follows, that, the crop may be in fact, more plentiful.

In the common way of sowing, the earth appears at first sight well covered with plants. But as all these plants cannot find sufficient nourishment, and it is impossible to assist them by culture, many of them perish before they ripen, the greatest part of them remain poor and stunted, and the seed is almost entirely lost: whereas by the new method, all the plants find sufficient nourishment, and being assisted from time to time, by proper culture, become strong and vigorous; insomuch that we have seen lands cultivated in the common way, not yield the fifth part of the produce of lands sown and cultivated according to the new method.

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A quick-hedge, planted between two plowed fields, of only a foot thickness at bottom, and eighteen feet in length, will yield at the end of fourteen years, as much wood as a copse of the same wood, which should be eighteen feet square. Yet if both be cut down every year, the copse will yield perhaps ten times the quantity of wood that hedge would do. Why does a space of eighteen feet square planted in copse-wood diminish in the quantity of wood it yields, more than a hedge does, after each of them has stood several years? It is evident that the difference consists in the copse losing every year a great number of branches for want of air and nourishment, and by its not being assisted by culture. This comparison shews the great benefit that may be expected from the new husbandry.

If it be said that plowing will break the roots of the plants; I answer, that some of these roots will only be removed to another place and into a fresh earth, and that those which are broken will be so only at their extremities, which, as we said before, will make them shoot out a greater number of new roots, fitter than the old ones to draw the nourishment of plants from the earth. There is no doubt but that one of the chief advantages arising from hoeing, digging, or plowing, is this cutting of the roots.

The plough has perhaps this advantage over the spade, that the latter cuts all the roots it meets with; whereas the plough often does no more than remove them from one place to another, from an exhausted, to a fresh earth.

Besides, when land is sowed according to our method, it is less exhausted than in the common way; or rather, it will be in a condition to supply several crops of wheat, which will become better and better every year, because the corn is sown in beds made in the middle of the former alleys, where the earth has been thoroughly and deeply plowed. This will be more fully proved hereafter. In the mean time we shall mention an experiment of Mr. Tull's, which confirms what we have been saying.

Half of a poor field, but well dunged, was planted in the common way with potatoes. The other half of the same field was planted in beds, according to the new husbandry, and plowed four times while the potatoes grew. The potatoes seemed, at first, to thrive best in the part that was planted in the common way; but afterwards, those planted in beds thrived exceedingly, and yielded a most plentiful crop, whilst the others were scarce worth the digging.

As it is proposed to plow the ground whilst the plants are growing, the alleys should be wider for large plants than for small ones; for such as remain long on the earth, as wheat, than for those which are but a short time on it, as barley. The breadth of the alleys should likewise be varied, according as the earth is stiffer or lighter. But, in general, when land is sowed with wheat, the alleys ought to be four feet, or four feet and a half wide.

C H A P. XII.

Of Change of Species.

BOTH the English and French have most of their flax seed from Flanders; and it is observed that when they sow that seed, the crop of flax is much finer than when they sow their own.

Cauliflower seed was for a long time brought from Malta, melon-seeds from Italy, the seed of lucerne from Languedoc; and good farmers are very careful in changing part of their seed corn every year.

There seem to be many reasons why this practice should still be continued.

Some plants agree better with one climate than another. Such will thrive best in the climate that may be called most natural to them. Sickly plants never bring their seeds to perfection; and to this it is undoubtedly owing, that the seeds which are gathered in a climate that does not agree with the plant, produce that plant less perfect than those which are gathered in a climate that is natural to it.

With all the art the French make use of to raise melons, they fall short of those of Italy, where this plant grows almost without culture*. If they did not take care to save the seed of their best melons, they would soon have no good ones left. But as their best melons are inferior to those of Italy, so their best seed may be compared to the middling seed of that country. This shews sufficiently how right it is to bring the seeds of plants from those countries where they thrive best.

It is evident that in the same province, the quality of the soil may have the same effect on corn, as the climate has: for when plants grow stunted and sickly in a poor soil, it is natural to believe that

* This, says Mr. Duhamel, is disputed: for though in hot countries all melons are eatable; yet some pretend that there are few so good in Italy, as at Paris and in Touraine.

that the seeds must partake of the weakly disposition of the plant which produced them; and that their productions cannot be so fine as those which grow from the seeds of strong and healthy plants. For this reason Mr. Tull advises to take the seed corn from a richer soil than that in which it is to be sowed, and rather from well cultivated land, than from land that is not so. We cannot say we think him wrong; tho' the contrary opinion is almost generally received: because, the first productions of a fine good seed, being strong and well conditioned, more may reasonably be expected from them, than from a poor weakly plant.

Another advantage in changing the seed, is, that there are some weeds which delight in particular spots, and do not grow so freely elsewhere. If a farmer sows wheat of his own growth, he increases the weeds which thrive particularly in his land; whereas, by changing his wheat, the weeds which he brings into his ground, not being in the soil that agrees best with them, will do less damage to his corn.

However, Mr. Tull thinks, that change of seed may be dispensed with, by the means of the new husbandry; because, by his method of culture, almost all weeds are destroyed, and the plants being very strong, their seed ought to be preferred to any other for sowing; especially when they are not foreign plants, which borrow their quality from the climate they are raised in.

What is here advanced may admit of some difficulty, for it is known, (and Mr. Tull allows it) that small wheat produces as strong plants as the largest. If so, wheat that has grown in bad land, would be as good for sowing as the very finest, provided it were well conditioned in other respects.

Dr. Home, p. 136. accounts very rationally for the advantages arising from changes of crops, from the different effects of their roots.

" The fibrous rooted divide directly into small fibres which run in all
 " directions, but mostly horizontally. The carrot-rooted send one
 " great stem directly down, which has lateral fibres. The former,
 " in which class are reckoned all the white grains, rye grass, &c.
 " consolidate the ground; while the latter, in which class are reckoned the leguminous plants, turneps, carrots, clover, attenuate
 " and loosen the earth exceedingly. The fibrous roots must bind
 " the soil together like so many threads, while the carrot-roots
 " divide like a wedge, and by their mere mechanical force, cut the
 " earth. The leguminous plants, by covering the soil, keep it
 " moist,

“moist, hinder the sun from consolidating it, and destroy weeds, which help so much to bind it. Perhaps the carrot-rooted may operate likewise, by separating more moisture from the root to keep the earth loose.”

We shall conclude this chapter with observing, that when we admit that plants degenerate in climates or soils which do not agree with them, we are far from thinking they change their species thereby; that wheat becomes barley, oats, tares, &c. This opinion is so exploded now, that it needs no refutation. We cannot however avoid mentioning the following experiment, from M. Duhamel, made by a neighbour of his in the country.

The chevalier de Laumoi, in order to satisfy himself whether March wheat does really degenerate into barley, as many have asserted; and well knowing it is almost impossible to buy wheat in which there is not some mixture of barley, any more than it can be had absolutely free from rye; picked grain by grain a quantity of March wheat sufficient to sow an acre of land, and at the same time sowed another acre with seed bought at market, without being culled. He was not surprised, at harvest, to find barley in this last acre; for, as he had sowed it, it was natural he should reap it: but in the other acre, where he was sure he had not sowed any barley, he did not find a single ear of it; nor could he, on a nice examination, find one grain of barley in any of the ears. If therefore a little rye is found in wheat, and a little barley in March wheat, it is because these grains are sowed in the same season, in lands equally prepared: they are gathered in at the same time, and laid up in the same barn. This is more than enough to occasion the mixture that is almost always observed.

After having mentioned the general principles on which the new husbandry is founded, we shall apply it to the particular culture of different plants, such as wheat, turneps, sain-foin, lucerne, &c. We shall begin with wheat; first in the old, and then in the new way.

C H A P. XIII.

Of the Culture of Wheat.

SOME farmers plow down their wheat stubble immediately after harvest: some burn the stubble before this plowing: others delay this plowing till after seed-time, and others even till spring: not only to allow time to collect the stubble, which serves to thatch

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their houses, fatten their cattle, or heat their ovens; but likewise because they are then sufficiently employed in preparing their grounds for sowing.

Farmers seldom give this plowing, which they call *winter-fallowing*, but to grounds newly broke up, or to that part of their land, which they intend to sow with barley or peas; and in that case, the land should be plowed twice in the spring; because, if it is plowed but once, the old surface, on which the former crop grew is again turned up; and barley and peas requiring a fine tilth, more than one plowing is necessary.

Those who plow their stubble immediately after harvest, are obliged to give a second plowing before they sow their oats. Thus all their land is winter-fallowed; and their return at harvest generally repays this expence and labour; for the winter fallowing is always of singular benefit to the ground.

Oats are sown and harrowed during the month of March, or in the beginning of April. When they are about four inches high, the farmer takes advantage of a shower, which softens the clods, to run a wooden roller over the ground, which, by breaking the clods, lays fresh earth to the roots of the plants, and smooths the surface of the field, so that the mowers are able to cut the oats close to the ground which it is very fit they should, because oats seldom grow high.

Oats are reaped soon after wheat, and then begins the year of fallowing, during which the earth is prepared for receiving wheat the year following. We must not however think that the plowing, or plowings, which are given to the oats, are of no benefit to the wheat. We rather think that the land which has been twice plowed for oats, is the better prepared for the plowings necessary to bring it into a proper tilth for wheat. This has been our reason for saying thus much of oats, though this chapter is more immediately intended for the culture of wheat.

The first plowing which is given to a fallow, is to turn down the stubble of the oats. This may be done as soon as the oats are off the ground: or it may rather be delayed till the seed time is over. 1. Because it is a busy time. 2. Because, by delaying it, numbers of seeds sprout up, which are so many weeds destroyed. 3. Because the cattle enjoy the benefit of the pasture which the stubble yields. 4. Because, to perform this plowing well, it is necessary

necessary that the earth be moistened by some showers; that the plough may go as deep as the quality of the soil will admit.

This winter plowing should be given as soon as the wheat sowing is over, provided the farmer be sufficiently forward in the work necessary in spring: and the ground should be plowed deep, that it may be mellowed during the winter. Though the earth should plow rough and grow hard, no inconvenience will arise therefrom. The winter's frost will moulder it. Therefore we think it is of great advantage to finish this first plowing before the frost comes on. But our farmers in general do not begin it till after their spring seed time is over.

As soon as the first plowing is finished, the land that was first broke up is plowed a second time, or, as it is commonly expressed, *Two-fallowed*. This is done about Midsummer. For this second plowing, the ground should be neither too dry nor too moist: for if it is hard and plows rough, there are now no frosts to moulder it down. There is no harm in plowing as deep as the soil will admit of. If the ground is level, or has been plowed into broad lands, the second plowing is across the former. If it has been plowed in ridges, the directions given in Chapter IX. are to be followed.

The last plowing is given immediately after harvest. The different qualities of soils, and the circumstances of the weather, will oblige the farmer sometimes to vary the method we have hitherto laid down.

1. Light lands are neither plowed very deep, nor so often as strong soils.

2. Strong lands cannot be plowed too often. If it be possible to break them up before the winter frosts, the earth will be mellowed and better prepared.

3. Some lands will be rendered less fertile by being plowed too deep. Others are benefited by deep plowing. We remember having somewhere read of a man extremely curious in the culture of his lands, who had two ploughs following one another in the same furrow, in order to stir the ground to a greater depth. This practice might in some measure answer the design of Mr. Tull's four-coulter'd plough; and in some countries they plow so deep, that they are obliged to have six oxen to a plough.

4. Farmers, who have plenty of horses, sometimes bestow a plowing extraordinary upon their lands, especially when weeds grow much.

5. These plowings are sometimes interrupted by great droughts*, and more frequently by heavy rains. Judicious farmers partly avoid this inconvenience, by chusing such part of their land as will suffer least by being plowed in too wet or too dry weather. For example, the plough, which would poach strong clayey land in rainy weather, will not have that effect on sandy or stony grounds: and when the weather is dry, some lands will plow up in great clods, while others break into a fine mould.

6. When there is a great depth of good mould, it may be renewed every ten years by trenching†. But as this work is very expensive, the same end may be answered by drawing two ploughs one after the other in the same furrow.

7. The ancients are very particular in their directions not to plow when the earth is very dry, very moist, or frozen.

If the earth is very dry, its surface is sometimes so hard, that the plow cannot pierce it; and if it does, it breaks it up in large clods.

If the ground is too wet, it will be poached in plowing, and become full of weeds: and if strong, it will be kneaded as it were into a paste, so that another year's fallow will scarcely recover it.

It may be laid down as a general rule, never to plow when it rains, or when the earth is so moist that the plow does not scour; for if it clogs in the least, the plowman ought to stop directly.

If the frozen surface be turned down by plowing, it will remain longer unthaw'd by reason of its depth, and thereby chill the earth.

Dungs are generally distinguished into three kinds, viz. 1. The dung of the larger cattle, such as horses, asses, oxen, cows, and hogs. 2. Sheeps dung. 3. Poultry and pigeons dung.

Grounds that have been marled, or on which sheep have been folded, are never dunged. The proper time for spreading the stable dung is before the twy-fallow, or at least before the last plowing. This is likewise the time for spreading lime.

In lands that lie near the sea, the farmers manure with shells, sea

* One of the great advantages of the new husbandry is, that strong soils never have time to grow so hard as not to admit the plough, even in the driest weather; especially if only one row of turneps is sown in a bed, or two of wheat: therefore, contrary to the general opinion, strong soils are still more benefited by it, than light.

† This practice was followed in Italy in the time of Cato, and even as late as Columella. They called it *Pastinatio*.

sea weeds, and the slimy mud which the sea leaves in creeks, before they twy-fallow; to allow time for these substances to rot and mix more thoroughly with the earth. Some sow by hand poultry and pigeon's dung on the corn, after the hard frosts are past. They reap great profit from this dung if the year is moist: but in dry years it is rather hurtful. We would therefore rather advise spreading it like sheep's dung, before the last plowing.

When the ears of wheat are very full of grain, they are half-threshed without unbinding the sheaves. By this means we obtain the best and ripest grain; with few seeds of weeds; because the weeds, being shorter than the corn, are generally at the bottom of the sheaf. Some farmers buy the gleaners corn, which being gathered in single ears, is generally the soundest and best.

The common practice is to sow wheat by hand, and custom brings the sower to spread it pretty equally. In smooth ground it is generally harrowed in: but the harrow not being able to bury it where there are large clods or stones, two rollers are made use of, fix'd in a frame, and full of iron spikes. These spikes break the clods, stir the surface of the earth, and cover the seed with it. This roller is not fit for strong soils. The seed is there sown under furrow. This plowing is very shallow, that the grain may not be buried too deep, for then it would not grow: but if the earth is the least moist, it will be poached, grow hard, and be greatly hurt by rolling.

When the farmer has sown his corn, his trouble is at an end till harvest. He then reaps it. We shall only observe, that wheat may be cut before it is full ripe; for it will harden afterwards in the sheaf. If it is let stand till too ripe, it will shed a good deal in cutting, tying, and carrying home. It is partly to prevent this inconvenience, that it is tied in the evening, and carried off the ground in the morning.

Some authors relate, that in Piedmont, they formerly drew a light harrow over their corn when it had spindled: and they add, that tho' a great many of their plants were destroyed thereby, the crop was however much bettered by it.

There are likewise farmers, who, to thin their corn when it grows too thick, let in their hogs to destroy part of it. These practices, which cannot readily be approved of, may create the greater confidence in the new husbandry.

When M. Duhamel published the first volumes of his *Culture des*

des Terres; his countrymen were unacquainted with the drill husbandry. It was therefore necessary to make them acquainted with the principles of that husbandry, and to give general directions for the culture of such plants as are most useful to farmers. The experiments hereafter related contain the best and fullest instructions for what ought to be done in the culture of each of these plants. We shall therefore refer the practical Farmer to those experiments, and mention here only the following general observations.

Though the culture that is bestowed on plants whilst they are in the earth is highly beneficial to all kinds of them, it is still more necessary to those which remain long in the ground. Therefore wheat, which remains nine months in the earth, requires more culture than barley, oats, or buck-wheat, which remain in it but three, four, or five months.

Wheat is sowed in autumn, after the earth has been brought to a fine tilth: it springs up, and pushes forth some leaves and roots; and when the winter is mild, the roots extend themselves, and the plant shoots out new stalks, or, as some call it, *tillers*: but by the winter rains, and the melting of the snow, the particles of the earth are so closely united together, that the soil is almost as hard and sadden'd in the spring, as if it had not been plowed at all. Yet this is the season in which the wheat ought to shoot with the greatest vigour: but instead of that, we often see its leaves turn yellow, its stalks dwindle, and the plant in a languishing state. Wheat sometimes looks better in the spring in a middling soil, than in one better adapted to that plant; because the latter grows stiffer and harder than the former.

Plowings, at proper seasons, give great vigour and strength to plants, preserve them green and in good condition, and destroy the weeds in the alleys. But as the plough cannot reach the weeds which grow between the rows, or in the beds, it is necessary to destroy them as much as possible before the land is sown: and it will be easier for the weeders to root them out of the beds without hurting the corn, by following the new husbandry, than by the old.

Mr. Tull mentions several experiments which prove, 1. That wheat grows better in land plowed according to the new husbandry, without being dunged, than in land equally good and well dunged, but cultivated in the old way.

2. That a field which had been under wheat the year before, yielded

yielded a better crop of the same grain, by means of his horse-hoeing husbandry, than a field of equal goodness did after a fallow.

3. That land cultivated in his manner, requires no rest; but on the contrary, is better fitted for wheat every year, provided the same culture be continued.

Plowing, especially of strong lands, should be avoided as much as possible, when the earth is wet. Instead of loosening the mould, it would harden it. We know by experience, that where the bank of a ditch is made up with dry earth, it soon moulders down; whereas it will last years when it is raised with earth that is wet, or as it were made into mortar. So, if land is plowed when too wet, it will be so poached as sometimes to require several plowings to recover it. We say, sometimes; for if great heats, which as it were bake the clods, are succeeded by rain, the clods crumble into dust, in the same manner as quick-lime. Frost has the same effect.

It may therefore be laid down as an almost general rule, that the season cannot be too dry for plowing; and that the earth is always in fit condition to be plowed, if it be not so wet as to be poached.

When the earth is brought to a fine tilth, it should be harrowed twice; taking care to keep the horses in the furrows, that they may not trample and harden the ground on which the wheat is to be sown.

Raising the earth up into ridges during the winter, if the soil be strong, will mellow it, by exposing a greater surface to the frost, and thereby render it fitter for nourishing the plants in the spring: for the frost, which enlarges the dimensions of the water that is mixed with the earth, powerfully divides the soil, and renders it extremely fertile.

The depth at which the seed should be sown, depends on the nature of the soil. It must be buried deeper in a light, than in a stiff soil. The depth of half an inch will be sufficient in the last; and it may be sowed three inches deep in the other. As by the new Husbandry stiff soils are reduced to a fine mould, it is easy, with the drill plough, to sow the seed at what depth is thought most proper.

A single grain of wheat, planted in a garden, has produced 80 and sometimes 100 ears. If, one with another, each ear contains 50 grains, it follows, that a single grain is capable of producing 5000. It is certainly for want of proper culture, that every grain of wheat which is sown in the earth, does not produce so extraordinary an increase.

crease. A whole farm cannot indeed be so perfectly cultivated as a small spot in a garden may be, where only a few plants are raised: but by means of the new husbandry, 30, 40, or at most 50 grains, sown in a square of nine feet, have yielded 250 ears; and of these ears some were eight inches long, and contained 100 grains. If all the ears had been equally fruitful, the increase would have been 6000 for one: but as all ears are not equally furnished with grain, we may reckon, that if one grain in the common husbandry yields ten, in the new husbandry it will yield an hundred.

There are other considerable advantages attending the new husbandry. Little or no dung is employed: the earth is not rested: it is not taken up with grain of less value, nor is the expence increased; for the culture which is bestowed upon the corn whilst growing, prepares the ground for the ensuing crop, and only two thirds of the ground are plowed. This horse-hoeing answers the end of the four plowings given during the year of fallow: they are even more beneficial: for it has been observed, that the third crop of a field which was sowed with wheat five years running, was a twentieth part greater than either of the preceding crops, and that the fifth was the best of all.

The farmer must not therefore repine at the seeming loss of the alleys, seeing that his lands are constantly employed, and that the wheat branches out into so many stalks, that, if spread equally over the whole field, as in the common husbandry, they would nearly cover all the alleys.

C H A P. XIV.

Of the advantages of the New Husbandry.

TO form a just idea of the advantages of the culture which Mr. Tull proposes, we must not consider whether each grain of corn that is planted in the new way, produces a greater number of grains, than it would do by following the old way.

This comparison would be too favourable to Mr. Tull. Neither must we content ourselves with examining whether an acre of ground cultivated according to the new principles, produces much more than the same quantity of land cultivated in the common way would do. In this, the new husbandry might perhaps not have any great advantage over the old method.

The

The way to draw a right parallel between them, is,

1. To examine whether all the lands of a farm produce, upon the whole, more corn when cultivated according to the principles of the new husbandry, than the same quantity of land would do, if managed in the old way.

2. To consider whether the new husbandry does not require so much more expence than the old, as to counter-balance or exceed the profit that may be expected from it.

3. To be certain which of the two methods is least liable to those accidents by which crops are so frequently damaged.

To the first of these articles, Mr. Tull says, that the same quantity of ground, for example, an acre, will produce much more corn when cultivated according to his principles, than if it were managed in the old way. Let the stalks of the wheat which grows in the beds, says he, be distributed over the alleys, and the whole surface of the ground will be as well covered as it generally is in the old husbandry; but the ears will be much longer, and fuller of fine plump grain, which will render this crop by much the most advantageous.

It will, doubtless, not be readily conceived, that three rows of wheat placed in the middle of a space of ground five feet wide, can possibly, by their fertility, supply the deficiency of all the rest of that ground on which there is no wheat; and Mr. Tull may therefore be suspected of exaggerating the advantages of a culture of his own invention. I will not dispute this point, if it be insisted on; notwithstanding the great probability of his arguments in support of it: but, on the other hand, it must be allowed that, in the common way, one third of the land is rested during the year of fallow, and produces nothing; another third is occupied by grains less valuable than wheat; so that only one third of all the lands of most farms, is designed for wheat.

According to the new method, all the lands are sowed with wheat: and though only fourteen inches are employed out of every breadth of four feet and a half, or five feet; yet, as the roots extend considerably farther, one third of the whole may be said to be under corn. The question then is, whether these rows of wheat produce a sufficient quantity of grain to make amends, not only for the want of the crop of oats, which farmers generally reckon worth one third of a crop of wheat, but also to indemnify the farmer for his

trouble. The experiments which we shall give hereafter, will prove that they do.

To the second article, Mr. Tull says, that the culture of land in his way, costs less than in the old husbandry. This is true of an equal quantity of ground cultivated each way: but as, in the new husbandry, all the lands of a farm are to be cultivated, and in the old husbandry, the third part receives no culture whilst under wheat, and the third that is under oats, is generally plowed but once, there is but one third of the farm which receives a thorough culture, and that is the part which is under fallow for wheat. In this light, it is not possible but that a farm must cost more in cultivating it according to the new husbandry, than the old. The only question again is, whether the greater produce in the new husbandry, will recompense the additional charge.

With regard to the third article, it may be observed, that while the corn is in the ground, it is exposed to many accidents, some of which cannot be prevented: such as hail, which breaks it down; violent winds which make it shed, perhaps the very night before it is reaped; continual rains, which make the ripe grain grow; severe frosts in the winter, which damage the roots, and untimely frosts which hurts the ear when spindling; hot glooms which mildew the corn, &c. It does not appear that any culture can prevent these accidents: but we shall shew in the following articles of the distempers of corn, and of weeds, which sometimes rob us of a third of our crop, that they are less to be feared in the new husbandry, than in the old.

C H A P, XV.

Of the Distempers of Corn.

MR. Duhamel is much more distinct in his account of the distempers of corn, than any English writer has hitherto been. Though they may be reduced to *mildew*, *blight*, and *smut*, he has distinguished them by several other names, which we shall endeavour to explain as they occur; and, taking them in the above order, we shall begin with the

MILDEW; which the French call *rouille* or *rust*.

THIS distemper attacks the blades and stems of corn. It covers them with a powder of the colour of rust of iron, whilst they are in their greatest vigour. This substance does not adhere strongly

to the blades: for it has been frequently observed, that the hair of white spaniels has been full of this powder, after they have run thro' a field attacked with this disease. It is likewise known, that if the infected corn is washed by a plentiful rain, the *rust* disappears almost entirely, and the grain suffers little from it. Farmers give it the name of *rust*, from the colour of the powder, and it seems to be the same distemper which the Roman writers call *rubigo*.

This *rust* is usually imputed to dry gloomy weather happening whilst the corn grows with the greatest force. We have many times observed, that when a hot sun succeeds such dry hazy weather, the corn was covered with *rust* in a very few days.

This distemper is of very bad consequence; for the finest corn is suddenly brought almost to nothing, when it is entirely attacked with it.

If *rust* attacks the corn whilst young, before the stem begins to rise, the hurt is less, provided there comes on a season kindly to its farther growth. The plants are only weakened, as if they had been fed or mowed. They shoot out anew, and produce ears. The straw is short, and the ears are small. But if both blades and stalks become rusty, the farther growth of the plant is stopt, and the grain gets no more nourishment; so that the crop is exceedingly diminished.

This distemper is well worthy the attention of every inquirer into nature, who interests himself in the success of farming.

The learned Mr. Tillet, director of the mint at Troyes, treats of this distemper, but only occasionally. He thinks it is caused by a sharpness in the air in dry cloudy weather, which breaks the vessels interwoven with the substance of the blades and stem, and makes them discharge a thick oily juice, which, drying by degrees, is turn'd into that rusty powder. He has examined, with a good microscope, many plants of corn whose stems and blades were covered with *rust*, and saw distinctly many small openings in the membrane covering the plant, where the powder lay. He observed that the juice, now dried to a powder, issued from these small openings, over which he still perceived some pieces of the membrane, which imperfectly covered the openings.

This distemper is called *mildew* in England. Our air is seldom so dry as to exhale all the moisture of the glutinous exudations, and thereby convert them into the rusty powder above described. The cause here assigned, seems much more reasonable than the thick

clammy dews which some of our authors mention, as falling in close weather, stopping the perspiration of plants, and hindering the sap from ascending to nourish the flowers, &c.

Mr. Tillet, in support of his opinion, quotes a memoir of Mr. Reneaume, published in the Transactions of the Academy of Sciences, on the extravasation of the nutritive juice of Walnut-trees in Dauphiny; of the manna of Calabria, which is not a dew, but the extravasated juice of the leaves of a kind of ash; and what M. Muschenbroeck relates in his Physical Essays, of thick and oily juices, which issues out at the excretory vessels of leaves, and stop there in the consistence of honey.

Mr. Tillet, from several facts which he mentions, concludes that the *rust* or mealy powder which is observed on many plants, is not a collection of the eggs of insects; but that it depends on the quality of the juices of particular plants, when the thinner parts are evaporated. Thus, it is red on garden beans, of a rusty colour on all kinds of corn, greenish on the plum, yellowish on the ash, white on larch trees, &c.

M. Duhamel tried frequently to produce the same effects which the dry weather occasions, by applying to the leaves of many plants, acid and corrosive liquors, to others alkaline and spirituous liquors, and frequently such clammy glutinous substances as might stop the perspiration, without hurting the texture of the plants. These trials have not produced any thing like rust. But who can tell how far experiments may lead philosophers? Some little circumstance may have escaped us, which, observed, might have led us near the object of our search. The public welfare calls on all attentive observers, to exert themselves on so useful a subject.

Mr. Worlidge's opinion of *mildews*, which he holds to be quite different things from *blights*, is, that they are "caused from the
" condensation of a fat and moist exhalation in a hot dry summer,
" from the blossoms and other parts of vegetables, and also from
" the earth itself, which, by the coolness and serenity of the air in
" the night, or in the upper serene region of the air, is condensed
" into a fat glutinous matter, and falls to the earth again; part
" whereof rests on the leaves of the oak, and some other trees
" whose leaves are smooth, and do not easily admit the moisture
" into them, as the elm or other rougher leaves do; which *mildew*
" becomes the principal food of the industrious bees, being of itself
" sweet, and easily convertible into honey.

" Other

“ Other part thereof rests on the ears and stalks of wheat, be-
 “ spotting them with a different colour from what is natural; and,
 “ being of a glutinous substance, by the heat of the sun, doth so
 “ bind up the young, tender and close ears of the wheat, that it
 “ prevents the growth and compleating of the imperfect grain
 “ therein; which occasioneth it to be very light in the harvest,
 “ and yield a poor and lean grain in the heap.

“ But if after this *mildew* falls, a shower succeeds, and the wind
 “ blow stiffly, it washeth or shaketh it off, and are the only natural
 “ remedies against this sometimes heavy curse.

“ Some advise in the morning, after the *mildew* is fallen, and be-
 “ fore the rising of the sun, that two men go at some convenient
 “ distance in the furrows, holding a cord stretch'd streight between
 “ them, carrying it so that it may shake off the dew from the tops
 “ of the corn, before the heat of the sun hath thickened it.

“ The sowing of wheat early hath been esteemed, and doubtless
 “ is the best remedy against *mildews*, by which means the wheat
 “ will be well filled in the ear before they fall, and your increase
 “ will be much more. For curiosity sake, wheat was sown in all
 “ the months of the year: that sown in July produced such an in-
 “ crease as is almost incredible. In France, they usually sow be-
 “ fore Michaelmas.

“ Bearded-wheat is not so subject to *mildew* as the other, the
 “ fibres keeping the dew from the ear.”

Mr. Miller takes the true cause of the *mildew* appearing most
 upon plants which are exposed to the East, to proceed from a dry
 temperature in the air when the wind blows from that point,
 which stops the pores of plants, and prevents their perspiration,
 whereby the juices of the plants are concreted upon the surface
 of their leaves, and being of a sweetish nature, insects are incited
 thereto; where, finding proper nutriment, they deposit their eggs,
 and multiply so fast as to cover the whole surfaces of plants, and,
 by their corroding the vessels, prevent the motions of their sap:
 and it is very probable that the excrements of these insects may
 enter the vessels of plants, and, by mixing with their juices, may
 spread the infection all over them; for it is observable, that when-
 ever a tree has been greatly affected by this *mildew*, it seldom
 recovers it in two or three years, and many times never is entirely
 clear from it after.

M. Chateau-vieux, whose accurate and judicious experiments will
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form the most considerable and most useful part of this work, was for some years so much taken up in establishing the horse-hoeing husbandry, that he had not leisure to attend to the distempers of wheat, till the great loss he sustained in the years 1753 and 1754, by the *rust*, engaged him, not so much to inquire into the cause, as to discover a remedy for it.

He is of opinion, that the powder which forms the *rust* is the extravasated juice of the plants: because, as soon as the *rust* comes on, the growth of the plant is stopt, the blade becomes no larger, the stalks grow no higher, nor the ears any bigger. "The juices," says he, still rise in the plant: they must therefore be turned to some other use; and it appears probable to me, that they are converted into this brown powder, which daily increases in quantity as long as the distemper lasts. I cannot think it a substance foreign to the plant, brought there by any external means.

"I have never seen corn struck with the *rust*, but in very dry weather, and (which is of importance to be observed) never but when there has not been the least dew for several days.—May not the want of that moisture, so friendly to vegetation, dry the surface of the blades and stems so as to make them crack, and the vessels, being broke, pour forth their contents?

"This opinion, continues he, is supported by an experiment which I made; and which likewise teaches us how to stop the progress of this distemper, when it seizes corn before it spindles.

"On the 6th of July 1753, I planted 159 grains of the wheat which I intended to use for seed. They did not begin to spring up till the 20th. On the 18th of the same month, I sowed 104 grains more. They sprouted soon, and had very large blades of a deep green. About the end of August, the blades changed their colour, and the *rust* soon appeared. It made an astonishing progress. The earth, for two feet distance from the rows, was covered with the rusty powder, and towards the rows of the plants it lay at least one-twelfth of an inch thick. The blades were almost entirely destroyed, and the loss of the plants seemed to me inevitable.

"As I was persuaded that this powder was the extravasated juices of the plants, I was in hopes that if I could turn the course of the juices from the distemper'd blades, the plants might produce new blades and stalks; as I observed that they were perfectly found wherever they were covered by the earth.

"The

“ The experiment was easy to be tried. It was only plucking off
“ all the blades close to the earth ; which accordingly I did on the
“ 28th of September, from one half of my plants.

“ New blades began to grow in a few days after this operation.
“ The plants throve greatly, and before the beginning of winter,
“ were again in full vigour. In the spring, they branched abundantly, and produced large ears, which ripened kindly.

“ The *rust* continued its havock on the plants which I had
“ not stripped of their blades, till they were entirely killed. They
“ did not produce a single ear.

“ This remedy can only take place when the distemper happens
“ in the autumn or spring: but if it happens later, when the stems
“ are grown, and the ears are ready to break forth, it seems to
“ me then incurable.

“ I have often observed, that the corn which is sown very early
“ is more subject to this distemper than what is sown later.

“ If we were acquainted with the causes of this *rust*, it might
“ be more easily prevented. In order to acquire this knowledge,
“ the lovers of husbandry should collect every observation they make
“ on this distemper, whence some useful hints may arise.

“ I observed, that when the wheat was rusted in the autumn of
“ the years 1753 and 1754, the second crop of hay was so too.
“ The grass turned, from a beautiful green, to that rusty colour
“ which the corn had: it was covered with the same kind of powder, and diminished sensibly every day; and, as the whole of a
“ field of wheat is not, usually, affected at the same time, so it
“ extended only to some parts of the meadow.

“ This distemper in grass, is undoubtedly owing to the same cause
“ as it is in corn, tho’ its effects are different on each. It entirely
“ destroys annual plants, as in my experiment; but in grass, which
“ is a lasting plant, it destroys only the leaves, and the roots afterwards produce new blades; or perhaps the plants are preserved,
“ by the blades being taken off in cutting them for hay. This
“ is only conjecture: but as it is a matter of importance, I shall
“ be more careful in my future observations.

“ It is well known that bread made of rye which has been attacked by the distemper called *ergot*, is unhealthy, and causes
“ very troublesome diseases.—Is there not some reason to fear the
“ same bad effects from feeding cattle with fodder which has been
“ *rusted*? May not this be the cause of deadly disorders which
“ some-

“ sometimes cut off whole herds, and for which no remedy has
 “ yet been found? These diseases are sometimes reckoned conta-
 “ gious; perhaps on too slight an inquiry.
 “ This fear of the pernicious effects of distemper’d fodder, may
 “ be groundless, though it is founded on plausible appearances. It
 “ were to be wished for the public good, that where fodder is any
 “ way distemper’d, by rust, smut, &c. some part of it, the most di-
 “ stemper’d, were set apart to feed some cattle with, that we might
 “ be assured whether their health is affected, or diseases are brought
 “ on by it. If cattle fed with it for two or three months, continue
 “ in good health, it may afterwards be made use of with confidence.
 “ If we find them droop, the remedy is at hand: they must be fed
 “ with good wholesome hay, which will carry off the disease, then
 “ known to proceed from the bad quality of their food.”

OF BLIGHTS.

WHAT we express in England by the general term, *blight*,
 our author divides into different kinds, appropriating a par-
 ticular name to each. The first he speaks of, he calls

Coulure, i. e. Empty-ears.

CORN is said to be *coulé*, when the ears, instead of being full of
 plump grains, are entirely destitute of any in their extremities,
 or contain only a few small grains, in which there is scarce any
 flour, and which pass through the sieve, with the dust and seeds
 of weeds.

This may be owing to several causes:

1. Heavy and cold rains, when the corn is in bloom, may pre-
 vent the grains being render’d pregnant, as it happens to grapes, in
 the same circumstances, which remain small and without juice.
2. Others impute this evil to lightning, which seems probable
 from the known and great effects of electricity, with which the air
 is so abundantly stored in stormy weather. I have seen trees lose
 all their leaves after a storm, and others die entirely, which could
 be imputed only to the lightning: as the next neighbouring trees
 are not hurt when any thing of this kind happens to corn, it can
 scarce be of any great extent.
3. The ears are sometimes hurt by frost, just as they come forth.
 In this case, the ears which are entirely frozen, contain no grain;
 and

and if only the extremity is frozen, that part is without grain. If, by accident, the growth of the plants is interrupted whilst the grain is forming, that in the extremity of the ear, which is formed last, will suffer most. The frequent stirrings given the mould in the new husbandry, keeping the corn always in vigour, the grain will be formed more perfectly through the whole length of the ear; and therefore corn raised in this manner, will be less subject to this distemper, than any other.

M. Duhamel collected some handfuls of such small grains of wheat found in the extremities of the ears, and having sowed them, they almost all sprouted, and most of them produced very fine corn. This shews that the smallness of the grain is not always owing to its want of being impregnated.

What M. Aimen names *barrenness in corn*, may be included in this distemper. He says that when, by frost or any other cause, the male or female organs in plants are rendered incapable of performing their functions, the plants yield no fruit, tho' they otherwise look well: and he confirms his opinion by a quotation from Theophrastus to the same purpose. A bright sun, after heavy rains, he says, produces this effect; and he thinks it is but seldom, though sometimes, caused by insects.

Bleds echaudés & retraits: i. e. Parched and shrivelled corn.

CORN is said to be *parch'd* and *shrivelled*, when, instead of being plump, smooth, and full of flower, it appears wrinkled in the outward surface. It is true these grains yield good flour, which makes pleasant bread: but the flour is in small quantity, so that two sacks of this shrivell'd wheat shall yield perhaps, no more flour than one sack of sound plump wheat. Yet, if the corn is not greatly distemper'd, it sprouts very well, and may do for seed corn.

This appearance in corn is occasioned by whatever prevents the free ascent of the nourishing juices into the grain when it is almost formed. The following seem to be the chief causes.

While the corn is yet green, if great heats come on, the stalks dry, and the grains ripen too suddenly, without being filled. This is frequently the case when heats succeed a rainy season, which fills the plants with too much moisture. Sometimes the grain contains no flour at all.

By the new husbandry, wheat preserves its verdure at least a week longer than in the common way, which is a great advantage, because

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the grain has time to be duly formed, and to be filled with flour. Corn sown according to the new husbandry, being later in bloom than that which is sowed in the common way, is so far more liable to the danger of great heats. This is therefore a good reason for sowing earlier, that it may bloom as soon as in the common way.

It is not possible to prevent the effects of lightning or of frost, nor to alter the causes which hinder the grain's being impregnated. But by means of the new husbandry one considerable cause of this shrivelling of the wheat may be guarded against.

When the corn is lodged whilst the grain is yet milky, the juices cannot flow freely through its stalks which are then either broken or greatly bent. The grain, which receives no more nourishment, ripens without being filled with flour.

It is not the weight of the ears which makes the corn lodge. If the stalk is large and strong, it will support the ear, be it ever so full of grain. But to give it that strength, it is necessary that the air and sun should have free access to it, and that the plant have sufficient nourishment while it is in the earth.

In the common husbandry, the plants have less nourishment; and as the stalks stand thick together, smothered and covered from the sun, they are tender and brittle. But in the new husbandry, every stalk receiving abundant nourishment during the whole time of its growth, and being always exposed to the air and sun, it becomes large and strong enough to support the ear.

It is agreed, that corn which grows in a rich soil, is tall, and more liable to be lodged, than what is stunted in its growth. But this is owing to the weakness of the straw, and not to the weight of the ears. We frequently see that tufts of wheat which grow in vineyards and other places, exposed on all sides to the sun and air, are less subject to be laid than tufts which grow in the middle of large fields. Farmers finding that their corn on the richest land is most liable to be laid, cause it to be eat down when it is very rank, or mow it, in order to bring it to a level with the weak and short, and prevent its being lodged at harvest. This practice is very wrong; for the farmer thereby lessens his crop, or brings it on the level of a second crop, where the ears are always small and light. They are afraid of the grain's shrivelling, if the corn is lodged; and, to avoid that inconvenience, they have recourse to means which will certainly render the ears small and less stored with grain. Besides, the grain is generally good when it ripens in due season: but by feeding

feeding or cutting down the corn, its growth and ripening are retarded, by which means it is exposed to all the inconveniencies of a late harvest.

It will hereafter appear by many repeated experiments, that if the plowman is careful to turn the earth towards the rows of corn, at the last hoeing, thereby to give greater stability to the stalks when they have attained their height, the corn will be less liable to be lodged.

Mr. Tull observes, that in cold countries there are insects which prick the stems of wheat before the grain is full of that milky substance which forms the flour. These insects lay their eggs on the outward covering of the stalks, and when those eggs are hatched, they feed on the pith, and destroy many of the vessels, whence the grain, being deprived of part of its nourishment, remains light and shrivell'd.

The attack of these insects may be known by the black spots, thought to be their excrements, which are seen on the stalks.

When these insects do not attack the stalks till the grain is well filled, they do little hurt. For this reason, early corn is less liable to be damaged by them, than that which is late; and as the wheat that is first sown generally ripens the soonest, this is another reason for sowing early.

As it is observed that these insects chiefly attack the most thriving corn, perhaps because its stalks are the most juicy; one would imagine, that as the wheat which is cultivated according to the new husbandry is more vigorous than any other, it should likewise be more subject to be injured by them. Mr. Tull says, that in this case, a deep furrow may be cut near the wheat, about the middle of June, in order to cut the roots of the plants, and thereby lessen their luxuriancy. It does not appear that he ever tried this remedy, which seems very dangerous. As the straw is exposed to the air and sun, in the new husbandry, it may probably contract a hardness which does not suit these insects, since they are never seen in dry seasons.

Mr. Tull advises a better safeguard against these insects, viz. to sow the white bearded wheat, the stalk of which is not hollow, but towards the foot, the rest being filled with pith. It is suspected that they sometimes attack this corn too, by the black spots which are observed on the straw: but it is known by experience, that the grain never suffers thereby, being always plump, hard, and heavy.

Bled-glacé, i. e. glazed corn.

MEN skilled in wheat require that it be heavy, of a smooth surface, and bright yellow colour. If it is of a dead white, they judge it to be watry, *mouillé*; and if of a deep yellow, and inclining to be transparent, it is said to be *glacé, glazed*. This fault happens to corn that has been ripen'd by great heats, which have come before the flour was formed. This wheat sprouts well, yields plenty of flour, and makes good bread. I guess that this flour does not take so much water to knead it, as the flour of the best wheat does. This is the only disadvantage attending it, if it really be one.

Bled avorté, i. e. abortive, or rickety corn.

OUR author says he did not know this distemper in corn, till he had seen M. Tillet's memoir on that subject; but that he has since observed it. The following is the substance of that memoir, being a dissertation which gained the prize given by the academy of Bourdeaux.

1. The abortive ears grow on rickety stalks, of a white colour, with curled leaves.
2. The stalks appear rickety as soon as they are three or four inches high.
3. Whilst the rickety stalks are yet low, they are weak, and of a yellowish hue: their blades are of the same colour, and somewhat crimped or curled, as if they were blighted; and towards the root, the rickety stalks look stronger than others.
4. As the rickety stalks grow, they become of a green colour, and afterwards change to that blueish hue which is their distinguishing character: their blades remain curled, become likewise blueish, and never have the strength and consistence of sound blades.
5. This is not a distemper peculiar to corn growing in a poor ground. M. Tillet has observed it in corn growing in a rich soil, and even in the middle of a tuft of fine wheat. He has sometimes searched for it in vain in poor soils, where the corn was but in a languishing condition.
6. The roots seemed to partake of the same distemper. They were not entirely covered with their soft spongy coat, and in some parts they were grown hard like wood.
7. Rickety stalks seldom bear ears, either entirely good or entirely

ly bad. When the ears are good, they grow on upright stalks, with blades a little curled.

8. The abortive grains resemble very young peas, and have sometimes one, two, or three spots in those which are quite formed, so that they look like two or three grains joined together.

9. Abortive grain, which usually grows on rickety stalks, is sometimes mixed in the same ear with smutty grains, which last generally grow on upright stalks, whose blades are not curled. Of *smut* hereafter.

10. Rickety stalks carry ears which sometimes contain sound grain, and at other times abortive grains.

11. The abortive grains are seldom at the bottom of the ear; for which reason they shed easily when the husk or chaff is opened.

12. The blossoms of abortive grain are seldom duely formed.

13. The plants are sometimes render'd quite abortive, before the corn spindles.

14. After the abortive ears have been some time exposed to the air, they grow white, and the grains become black and dry.

15. We sometimes meet with stalks of wheat, which, tho' of the rickety kind, are strait and tall, and have only the blades of the third or fourth joint shrivelled or curled.

All these symptoms do not unite in the same stalk, but where the distemper is at the worst. When the grain is ripe, or rather when it is dried, it turns black, and looks so like the seed of cockle, that many farmers, who are unacquainted with this distemper, confound the abortive grains with the seeds of that plant.

M. Tillet suspects, that this distemper is occasioned by insects. He has found insects on the distemper'd stalks, where he saw drops of a very clear liquid, which he took to be the extravasated sap.

ACCIDENTS occasioned by INSECTS.

BESIDES insects, which are properly the subject of this article, there are several other animals which do considerable damage to corn. Field mice eat not only the grain, but oftentimes the plant itself. Rooks also destroy great quantities of corn with their strong beaks, and hares and rabbits eat it whilst green, and weaken the

the young plants, so that they branch but little, and produce weak ears. Pigeons have not bills strong enough to root out the grain when covered with earth, nor do they feed upon the young corn: they only pick up the grains that are not covered, and which must infallibly become the prey of other animals, or be dried up by the sun. Partridges do no more harm than pigeons, for they do not scratch. They only eat the green corn, which can be of little consequence, unless they are in great numbers indeed, and in a place where but little corn is sown. Sparrows make great havock at harvest time, by the vast quantity of corn which they eat, especially near hedges or villages. Bearded wheat, and rye, are less their prey than any other grain. This is worth knowing: for it is better to have a full crop, even of rye, than to have half a crop of wheat eat by them, after being raised with great care. Small snails destroy a great deal of wheat in some soils.

But the losses occasioned by such creatures, are not what we propose to treat of here: we mention them only by the bye, and now proceed to the insects.

There is a small kind of worm, which gets into the roots, chiefly of oats, and, working upwards, destroys all the inside of the plant, which perishes soon after. I suspect it to have been an insect of this kind that destroyed so much wheat in the neighbourhood of Geneva, and which M. de Chateau-vieux describes thus. "Our wheat, in the month of May 1755, sustain'd a loss, which even that cultivated according to the new husbandry did not escape. We found in it many little white worms, which afterwards became of a chesnut colour. They post themselves between the blades, and eat the stems. They are usually found between the first joint and the roots. Every stalk which they attacked, grew no more, but became yellow, and withered. The same misfortune happened to us in the year 1732. These insects appeared about the middle of May, and made such havock that the crop was almost destroyed."

We too often find, in our kitchen-gardens, a sort of vermin called *vine-fretters*. They fix upon the roots of leguminous plants, which gradually turn yellow, and die. M. Tillet says he has observed the same insect in the roots of wheat. Messrs. de Reaumur and Tillet have likewise observed small caterpillars which are hatched in the ears of wheat. M. Duhamel tells us, that he long ago observed, and made drawings of small insects, some of a bright red,

red, and others black, which are found in great numbers in the ears of wheat. He suspected that these insects feed on a sweetish juice, which is in the ear whilst green. As M. Tillet was at first of opinion, that they might do considerable damage to the grain, he followed with great attention all their metamorphoses, of which he has given a full account in the before mentioned memoir.

Though insects, and other enemies to corn, whilst in the granary, do not properly belong to the present subject, we beg leave to give the following account, which was sent to M. Duhamel by a gentleman of Angoumois.

" The great loss, says he, which we have suffered in this province in our corn, and especially our wheat, for seventeen or eighteen years past, has put us upon making strict inquiries into the causes of a corruption with which our grain is infected. The common opinion is, that when the corn is in bloom, that is to say in the month of June, small white butterflies lay their eggs in the flowers. When the grain is ripe, the eggs are inclosed in it. As soon as the corn is laid up to be kept, it is found to ferment. This fermentation raises a heat, which hatches the eggs, whence little worms proceed, which are transformed into chrysalides, and these are afterwards metamorphosed into little grey butterflies, or moths. In this state they quit the grain, which is then void of flower. This insect not only spoils the grain in which it is hatched, but likewise communicates a most disagreeable smell to all the grain near it; a smell which is sometimes so strong and nauseous, that fowls, and even hogs, will not eat the grain.

" Others impute it to the *maize*, or Turkey wheat, which is sown in great quantities in this province, and which spreads its roots so far, and so impoverishes the earth, that other corn sown after it, in the same ground, can find no nourishment. This is not probable: for it could only alter the quality of the grain, but not bring on an entire putrefaction.—The two following experiments were tried to prevent it.

" A farmer had three or four acres of land which had been under grass for more than sixty years. He had plowed and dunged it well. He had his seed from Poitou; and, in short, took every precaution to guard against this contagion. The wheat ripen'd and was very good. He cut it down in a dry season, threshed it in the open air, and cleansed and winnowed
" it

“ it very carefully. It was laid in a granary which had no communication with any other, and which had an opening to the North. The farmer ordered it not to be laid above three inches thick on the floor, and to be turned twice a day. Four days passed before the least heat was perceived; but on the fifth day, it began to grow a little warm; and from that time the heat increased, notwithstanding every means that had been, and still continued to be used. All that could be done, was, to prevent its being so much spoilt as corn in general was that year.

“ The other experiment succeeded better. As soon as the wheat was threshed, well cleaned and winnowed, it was put into an oven heated to a certain degree. The floor of the oven was covered with wicker hurdles, on which the corn was spread four inches thick: the door of the oven was then shut, and remained twenty-four hours without being opened. Many have followed this example. Their grain has not changed: only its colour is not so bright. Care must be taken that the oven be not too hot: otherwise the bread made of this flour will have a burnt taste. It is likewise necessary to cover the bottom of the oven, lest the wheat should communicate its taste to it.

“ I confess that this operation is long and troublesome, where a great quantity of corn is to be preserved; for only ten or twelve bushels can be put into the oven at a time: and besides, it must be done the moment it is threshed; otherwise it will infallibly spoil.”

I have not had an opportunity, says M. Duhamel, of inquiring into the cause of the accident here complained of: but as the oven has been found so effectual a preservative against it, it would certainly be right to make use of the stove, of which I have given a description in my treatise on the preservation of corn. The method there advised, will not be so expensive, nor so troublesome as the ovens, and the price of making the stoves will bear no proportion to the advantages which will arise from the use of them.

Our author, like all the other French writers, divides the distemper which we call *smut*, into two kinds, viz. *Smut*, properly so called, and *charbon, coal*, so named from the wheat's looking as if it was burnt. He observes that it is of great consequence to inquire into the causes of *smut* and *charbon*, because we may perhaps arrive at the knowledge of effectual means to prevent these disorders, which frequently occasion such great losses to farmers. He begins with

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S M U T.

THE grains of smutty corn are tender, and filled with a black stinking powder, instead of the white flour which sound grain contains. As these grains are very easily broke, they spread their powder on the sound grains, which having on their extremity a little tuft of hairs, the powders stick there. Farmers distinguish the wheat thus vitiated, by saying that it is *black'd in the point*, (in French *qu'il a le bout*) and bakers avoid it, because it gives their bread a violet or purple hue.

As soon as the stalks begin to rise, if the blades are opened so as to discover the young ear, it will be found to be already distempered; and in this case, the pith or inside of the stalk likewise appears sometimes black.

As soon as the ear appears out of the covering which the blades form, it looks shrunk. All the coverings of the grain are so altered and shrivell'd, that the smut appears through them. As the powder in such grains has little cohesion, it is easily wash'd away by the rains, or carried off by the wind. If any of it remains, 'tis only on the points of the sound grain.

When corn thus *black'd in the point* has been kept for several years, and frequently sifted through an iron sieve, this colour vanishes. It may also be taken off immediately, by rubbing it with a cloth: which shews that the impression is only superficial.

Smutty corn is so thoroughly destroyed, that it cannot grow or germinate. There is therefore no room to fear that the distemper'd grains can produce their like. The corn which is only black'd in the point, grows very well.

Smut is not only a distemper of the ear, but of the whole plant; and it very seldom happens but that when one stalk is smutty, all the other stalks from the same root are so too. I never found but one sound ear on a distemper'd plant.

Authors are not agreed what the cause of this disorder is. Some impute it to inclemencies of the weather when the corn is in bloom. It is certain that cold rains at that time prevents the grains being impregnated: but it is well known that grain which is not impregnated, does not always become smutty: and besides, if it proceeded from any general cause, the whole would be affected; whereas there are sometimes only a few smutty ears among the best corn. 'Tis true, it is most frequent in rainy years; and Mr. Tull is therefore of

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opinion,

DISTEMPERS OF CORN. VX Part I.

opinion, that it is not the rain, but the moisture of the earth which occasions it. "I was confirmed in this, says he, by several plants of wheat taken up when they were in grass in the spring, and plac'd in troughs in my chamber window, with some of the roots in water. These wheat plants sent up several ears each, but at harvest every grain was smutty; and I observ'd, none of the ears ever sent out any blossom. This smuttiness could not be from any moisture that descended upon it, but from the earth, which was always kept very moist. The wheat plants in the field from whence these were taken, brought very few smutty grains, and much larger ears than these."

This experiment would seem decisive, if it had been repeated often enough. If the smut was occasioned by the wetness of the earth, a much greater number of stalks would be infected in the lower parts of the ridges than in the higher, which we never heard to be the case.

The Reverend Dr. Hales, suspecting that the smut might proceed from the seed's being bruised by the flail, took a number of grains of different sizes, and bruised them with a hammer. They sprouted and grew very well, without any smutty ears. This most skilful philosopher concludes from thence, that this is not the cause.

After the publication of M. Duhamel's first volumes, the academy at Bourdeaux propos'd for the subject of their annual prize, *the best account of what renders black the mealy substance of grain*. Of the many that were given in, our author mentions only M. Tillet's, which carried the prize. He likewise gives the substance of a memoir, presented to the royal academy at Paris by M. Aimen, M. D.

Both these gentlemen give, if we may be allowed the expression, an accurate anatomical account of this distemper, drawn from observations founded on their knowledge of the structure of plants. But as those disquisitions are rather curious, than useful to farmers, we shall give only their practical remarks, referring the learned in these matters to the Original, or rather to the Original Memoirs in the Transactions of both the Academies.

In answer to Mr. Tull's allegation that too much moisture is the cause of smut; M. Tillet planted a tuft of wheat in a vessel in which he kept the earth extremely moist, and had not one smutty ear.

He is of opinion that it does not proceed from any inclemency of the weather, or want of impregnation; because it takes place before the ears have appeared.

M. Aimen gives the following, as the signs of its first appearance:

1. The sheaths of the ears of sound corn are larger and more swelled, especially towards the middle, than the same parts are in the distempered ears.

2. The distemper'd ears have a smell like red herrings.

3. As soon as the distemper'd ears begin to shoot forth, and the beards appear, it is easy to distinguish them from the sound; for their beards are whitish, whereas the sound ones are green.

He observed some ears which were quite smut in the lower part, whilst the upper part was very little damaged. The distemper in this state does not affect the straw, the external part of the ear, or the stalk which runs through the middle of the ear. Wheat, oats, barley, spelt, and several kinds of dog's grass are liable to this distemper, and rye is not entirely free from it.

M. Aimen is of opinion, that the smut is produced by an ulcer which seizes the different parts of the blossom. He has spared no pains to discover the cause of this ulcer. He is well assured that it is not caused either by insects, or by the wetness or dryness of the soil; nor does it seem to arise from any fault in the juices, seeing that all the rest of the plant is pretty well formed.

He sowed corn blighted in all degrees, which either did not sprout at all, or produced stalks more or less vigorous, but all of them free from smut. He sowed some mouldy grains, each of which produced smutty ears.

M. Aimen thinks he has reason to believe that grain may become mouldy in the earth. He sowed some chosen grains, and when they had all sprouted, he took them up, and examined them with a microscope. He found small white threads or filaments on some of them. He planted them again, and these plants produced smutty ears. This experiment was repeated, with the same success.

It is hard to conceive that mouldiness, or, if you will, a kind of moss, can produce smut: for as soon as the grain has sprouted, and the plant is formed, the whole substance of the seed corn is exhausted. Whether it rots, or not, seems to be of little consequence to the plant, which no longer draws its subsistence from the seed. If the plant becomes mouldy, it may either die, or be stunted: but how this mouldiness should affect only the organs of fructification, so as entirely to destroy them, without doing any sensible injury to the rest of the plant, is not easily accounted for. To shew that the fact may be so, M. Aimen instances a wild-pink, which, for three

years, produced none but smutty seed, though the root was perfectly sound. If we suppose that the growth of plants is only an enlargement of what was in miniature in the seed, we may conceive that the blossom alone may be affected. But let us keep to facts, which we shall always find of much more importance than mere conjectures, too often unsupported by any great probability of truth.

M. Aimen agrees in opinion with those who think, that the powder of smutty grain will render sound corn smutty, if strewed upon it; but he does not think that the only cause; for it may happen that a year, in which there is a great deal of smutty corn, may be succeeded by another in which there is scarce any: or perhaps a year quite free from smut, may be followed by a year no less remarkable for great abundance of smut. This infection cannot be the cause that wheat gathered off the same ground, taken out of the same sheaf, and sowed without being prepared with any steep, shall in some fields produce sound wheat, and in others smutty.

This observation, and a persuasion that other causes may contribute to bring this disorder, as effectually as the smutty powder does, induced M. Aimen to try many experiments, from which he draws the following conclusions:

1. That the best ripen'd and soundest grains should be chosen for seed.
2. That the black powder certainly disposes corn to become smutty.
3. That the smut is to be feared as often as the seed time is rainy. This may be avoided by beginning to sow early.
4. Whatever weakens the plant, brings the smut; for seed-corn which has been pricked or run through with a needle, or which is not fully ripe, and that which produces lateral or second ears, is subject to the smut. As a proof that whatever weakens plants, causes the smut, he observes, that it is a frequent custom with them to cut rye as soon as it spindles, for food for their cattle; and that this rye generally produces other ears, which seldom contain any but distemper'd grain.

Mr. Tull tells us that the cure of this distemper was first found out by an accident, which he relates thus:

“ Brining of wheat, to cure or prevent smuttiness (as I have been credibly informed) was accidentally discovered about seventy years ago, in the following manner, viz. A ship-load of wheat was sunk near Bristol, in autumn, and afterwards at ebbs all
“ taken

“ taken up, after it had been soaked in sea-water; but it being
 “ unfit for making bread, a farmer sowed some of it in a field;
 “ and when it was found to grow very well, the whole cargo was
 “ bought at a low price by many farmers, and all of it sown in
 “ different places. At the following harvest, all the wheat in
 “ England happened to be smutty; except the produce of this
 “ brined seed, and that was all clean from smuttiness.”

We shall here copy the directions given by the author of the
New System of Agriculture, for the choice and preparation of seed
 corn:

“ Let your corn be brought into the corner of a large barn floor,
 or great boarded hall, such as few country houses are without:
 order a man, with a broad wooden shovel, to throw the corn, with
 all his force, towards the opposite corner of the barn, or hall: the
 last is generally the fittest for it. In this exercise, all light, small,
 shrivell'd grain, and the seeds of cockle, dandel, and other weeds,
 not being so heavy as the solid corn, will fall short, and lie nearest
 to the man who throws them; while such as are large, plump,
 and weighty, out-flying all the rest, are separated widely, and may
 easily be gathered in what quantity you please. Experience only is
 capable of making men believe the wonderful advantages of sowing
 seed thus chosen.

“ Take your corn, when it has been thus obtained; and throw
 it, by a bushel at a time, into a large vessel full of water: let a
 man stir it with a staff, as violently as he can, for a considerable
 while together, and then, giving it a little time to settle, skim off
 all that swims upon the surface; and repeat this labour till no
 more rises: after which, take out the corn which is sunk to the
 bottom, and lay it by for seed; proceeding in the same manner,
 till you have your intended quantity.

“ Now make a *brine*, by throwing *bay-salt* into *rain-water*, till
 it becomes of strength enough to bear an egg. In this liquor steep
 your *seed corn* for thirty hours: less time will have no manner of
 effect. Observe this, and regard not the contrary opinions of any
 men, let them pretend to never so much skill.

“ When you take your corn out of this brine, spread it upon
 a smooth floor, and, scattering upon it good store of the *fine-ground*
powder of slack'd lime, sweep it up and down, and mingle it with
 the corn, till every grain leaves clinging to another, and becomes,
 as it were, *candied* with the lime: and in this condition let it
 be

be sowed, never entertaining a moment's doubt of the infallible increase of your harvest.

Several farmers vary this steep, by adding to it a mixture of pigeons or other dung.

In most of the provinces of France, they make no use of salt; doubtless because it is too dear: but they steep the wheat in lime-water. For this purpose, they put it into baskets, and carefully skim off all that swims on the top, most of which would not sprout, and is only fit to feed fowls.

Other farmers pretend that the surest way to be free from smut, is, to change the seed every year; and that the seed which comes off a strong soil, is the best. A farmer in whom Mr. Tull had great confidence, told him, that, for several years, he had his seed corn from another farmer, who also changed his seed every year, and that he was free from smut, though the neighbouring farms were always infected with it: but above all, he assures us, that the drill husbandry is the most effectual cure.

M. Aimen, after giving an account of the seat and causes of this distemper, enumerates the remedies recommended by authors: lyes of lime, salt-petre, allum, verdigreas, vitriol, common salt, and the ashes of plants, are recommended by Mr. Pluche.

A mixture of water and urine, or a decoction of cypress leaves, are recommended as specifics by Columella and Pliny. The farmers boast much of the juice of house-leek and other cold plants; and Virgil recommends lees of oil.

As weak plants are most subject to smut, M. Aimen recommends good tillage, as a sure means of giving them strength and vigour. 'Tis probably for this reason that corn is very seldom smutty when managed according to the new husbandry.

He observes that all the lyes generally made use of, preserve the plants from mouldiness: and of all of them, lime seems to him the most effectual.

On the whole, he advises that the best wheat be chosen for seed; that it be reaped in fair weather; that it be threshed out immediately, and that it be sprinkled with lime the next day after it is threshed. He adds, that every method he has tried to make corn so prepared grow mouldy, has been ineffectual, and that he has never known it produce smutty ears.

M. de St. Mesmin de Lignerolle says, that the surest means of avoiding smut, and which he has practised with success ever since the

the year 1739, or near 300 acres of land, is, to change the seed every year, to be very careful that the seed corn be well dried and thoroughly ripe, and that it be not smutty, nor have any smutty powder sticking to it. He then pours boiling water on quick-lime, in a large tub, and after the ebullition is over, as much cold water as there was hot, and stirs it all strongly together, in order to dissolve and thoroughly mix the lime. The quantity of wheat intended to be sowed, is sprinkled with this lye, and then well stirred with a shovel, and laid in as high a heap as possible. It is best to keep the grain for a week after this preparation, turning it every day; for otherwise it would heat so as to destroy the germ. By these means, M. de St. Mesmin has had no smutty wheat, tho' all around him is very liable to that distemper.

M. Donat, near Rochelle, writes, that, thinking the ingredients generally employed in steeps, too dear for the use of farmers, he had studied for some years to find out something cheaper, which might be easily had in every province of the kingdom, and would therefore be of general use, not only to France, but to all Europe. I have had, says he, the good fortune to accomplish what I wished; for I now use only pigeon's dung, quick-lime, ashes, or sea-salt, where it can be conveniently had. I have sometimes made with these ingredients, steeped in water, so strong a liquor, that it has even destroyed the germ of the grain. But there will be no danger of that, if the following directions are observed, which are the result of seven years successful experience, even at times when farmers who have neglected to follow my example, have had such wretched crops as have not paid the charge of reaping.

The following receipt will be found of great service to preserve corn from smut.

Take quick-lime and pigeons dung, of each twenty-five pounds; forty pounds of wood-ashes, and twenty-five pounds of sea-salt, or salt-petre. Put all these into a tub large enough to hold half a hoghead of common water added to them. Stir them all well, with a stick, till the lime is quite dissolved. This lye will keep some time without spoiling.

When the corn is to be steeped in the lye, it must first be stirred. The grain is then put into a basket, and plunged into the lye, where it remains till it has thoroughly imbibed it; after which, it is taken out, and laid in a heap, till it is drained of all its moisture. Or, which is still better, take a mashing-tub, fill it with grain to within

within four inches of the brim, and then pour in the lye well stirred before-hand. When the tub is full, let the lye run out at the bottom, into some other vessel, in order to use it again for more corn. Let the grain be then taken out and laid in a heap to drain; and continue in this manner to steep all your seed corn. The wheat thus prepared, may be sowed the next day, and must not be kept above five or six days, for fear of its heating. This we say from experience. The quantity of lye above prescribed, will serve to prepare twelve or thirteen hundred weight of wheat.

Le Charbon.
THE French seem to give it this name, from the grain's appearing as if burnt. We shall therefore translate it *burnt-grain*. Mr. Lisle calls it *ustilago*, or *burnt-ear*.

The ears attacked with this distemper, are not, at first, readily distinguished from the sound: but after they have past blooming, they become of a brown green, and afterwards turn whitish, by which they are then easily known. The burnt grain is sometimes larger, and at other times less than sound grain. It swims on water. This distemper affects only the grain. The ears remain in a sound state: only they are white, and drier than sound ears.

Though all the ears which proceed from the same plant are usually attacked with this distemper, yet we now and then find sound ears on the same plant with the infected: nay, we have sometimes seen the grains of one half of an ear sound, whilst those of the other half were burnt; and at other times only a few sound grains in a distemper'd ear. We have likewise seen, though very seldom, one part of a grain sound, when the other part was burnt. M. Aimen has frequently cut all the ears off a flourishing plant, and others have grown in their stead; but the grain was burnt. This, says he, accounts for our so frequently meeting with burnt grain in fields, where some of the ears have been broken down by hail, in May.

When a burnt grain is crumbled, as it generally may, with ease, betwixt one's fingers, the inside is of a dark brown colour, and the substance contained within it, still retains some degree of firmness.

We have said, that smutty grains being often carried off by wind, or washed away by rain, do no great damage to the sound grain. It is not so with the burnt grains; for many of them are

sometimes so firm, as not to be crushed to pieces by the flail, shovel or sieve; but one of them ground to powder in the mill, is sufficient to alter the colour of a considerable quantity of flour.

The burnt grains have a bad smell, and retain a great deal of moisture: two qualities which render them very unfit for keeping.

As the burnt grains are lighter than the sound, many of them are separated by throwing the corn to a distance with the shovel, or by winnowing, or sifting it in the wind: but it is very difficult to get quite clear of them. When they are broken, they infect the sound grains, and stick to them, as we observed of the smut. The French farmers give the same name to both the distempers we have been speaking of, saying that the corn is *mouchet*, *spotted*, or *colour'd at the end*. This last is easily rubbed off with a cloth, and is likewise lost by long keeping after the corn has been frequently sifted, especially in cylindric sieves. Some farmers wash it off in fair water; which should always be done before such corn is put into any steep.

M. Tillet's memoir relates chiefly to this distemper. We shall pass over his accurate and curious experiments, and, as before, give only the result of his inquiries.

He found, 1st. That no kind of dung had any sensible effect in producing burnt grain or smut. The infected seed produced as much burnt grain in places not dunged, as in others that were. No kind of dung quickened or retarded the progress of this distemper. Sound seed-corn produced no more burnt grain in places that were dunged, than in those that were not dunged.

2. The straw of distemper'd corn, putrified, did not produce burnt grain: but such straw, not putrified, seem'd to produce it. The same may be said of the powder of burnt grain, when mixed with the earth.

3. In every trial of sowing corn *spotted* or *coloured at the end*, whether gather'd on the spot, or brought from a distance, the distemper prevailed to that degree, that sometimes three-fifths of the ears were bad.

4. Chosen wheat, taken grain by grain out of pick'd ears, in order to be certain that there were no distemper'd grains among it, being sowed, some in dung'd and some in undung'd land, some with and some without preparation, produced little or no burnt grain. The same chosen seed, sprinkled with the powder of di-

stemp'd grain, produced as many distemper'd ears as grain originally infected with it. This powder does not lose its contagious quality in a great degree of heat, nor indeed unless it be quite parched. It retains it for years as strongly as at first.

5. This chosen seed steep'd in a lye made of quick-lime and sea-salt, gave fewer distemper'd ears, than when sown without being steep'd. It produced still less of them when salt-petre was used instead of sea-salt.

6. The circumstance of sowing late or early, seem'd of little consequence.

Many farmers think it a very necessary precaution to wash the sacks into which they put their seed corn, because they think that even the small may infect the sound seed. M. Tillet thinks that if the sower has any of the powder on his hand, it will infect part of the corn he sows.

The same gentleman thinks he has remarked, that distemper'd plants of wheat are more easily affected by frost, than sound ones. If so, strong frosts are of great service, because, at the same time that they destroy those distemper'd plants, they render the earth better able to afford sufficient nourishment to the sound ones.

By M. Tillet's experiments, the contagious powder of wheat does not affect rye, or four row'd barley or bigg.

M. Tillet tried many experiments to discover the most effectual cures for this distemper; from which he draws the following conclusions:

1. The effect of the black powder is only superficial, and does not affect the internal parts of the grain before it is sown in the earth.

2. Whatever therefore removes this powder from off the outer surface, will greatly conduce to preserve corn from this distemper.

3. Grain perfectly free from all infection of this powder, will not produce distemper'd grain.

4. Grain blacken'd with this contagious powder, may be render'd sound, by clearing it entirely of the powder.

5. The action of sifting, and the precaution of washing the grain in several waters, lessen the effects of the contagion; but they are not sufficient to cure it; for he found several ears with burnt grain, tho' the seed had been washed in several waters.

6. Lime, tho' of greater efficacy than plain water, is not alone sufficient

sufficient. It may be remarked here, that the manner of liming corn, was formerly different from what is practised now. They then put the grain into baskets, which they plunged into warm lime-water. They stirred it strongly in the baskets, and carefully skim'd off all that swam on the top. By this means, they got rid of all the distemper'd grain. This was much better than simply pouring lime-water on a heap of grain, as is the practice now-a-days, and then turning it with shovels; or mixing with the grain lime-slack'd in the air, and reduced to powder.

7. Washing the grain touch'd with the powder, in several waters, is a very good precaution: but it must be afterwards steep'd in brine till it is thoroughly penetrated therewith, and then have powder of lime strewd upon it.

8. A strong brine of sea-salt is good, and may be used to great advantage where salt is cheap.

9. Salt-petre is better than sea-salt, and should be made use of where much nitrous earth abounds.

10. Strong alkaline lyes are still better. Pot-ash, salt of tartar, a lye made of any vegetable ashes abounding in salt, urine of men or cattle, become alkaline by putrefaction, &c. Of these, the easiest come at in every place, may be chosen to make a lye for seed corn. Near the sea, they make use of the ashes of sea-weeds. These ashes, rejected by dyers and others who use lyes, because they have too much sea-salt in them, may, for that very reason, be employed to greater advantage for seed corn.

As men generally love to raise objections, some may perhaps say, that if this distemper is so contagious as has been here represented, it would make such progress from year to year, that at last we should reap nothing but burnt grain: but this is not the case, for frequently a year in which this distemper prevails much, is succeeded by a year in which scarce any of it is seen. Such was the year 1754.

M. Tillot's observations are an answer to this objection: for hard frosts kill so many of the distemper'd plants, that its progress is happily stopt.

It may be again asked, if the contagious powder is the only cause, how comes there to be burnt grain in a province where it never was before? It may be answered, that other causes may produce it; particularly, as M. Aimen observes, whatever prevents the grains being impregnated whilst in blossom.

M. Delu boiled two pounds of salt of tartar in a quantity of water sufficient to steep an hundred pound weight of wheat, which he put into it while the lye was warm, and afterwards sprinkled it with quick-lime.

This grain was sowed the 11th of October 1755, in part of a field of three acres. The rest of the field was sowed with some of the same wheat, only steeped in lime-water. No difference appeared in the plants of these grains, during their growth; but some days before they were reaped, M. Delu, with an experienced farmer, examined them very carefully, and found a good deal of burnt grain in the part sowed with the wheat, which had been steeped in the lime water; but much less in the other part where the grain steeped in the lye was sowed. This confirms M. Tiller's experiments.

Of the distemper in rye, called ERGOT.

AS we know no word in our language answering to what is meant here by the French word *ergot*, we must retain it.

According to M. Aimen, the *ergot* in rye is the same distemper as the *charbon* in wheat. If there be any difference, it is owing to the different organization of the two grains.

1. The distempered grains of rye are larger and longer than the sound, and come out of the chaff, appearing sometimes straight, and at other times more or less crooked.

2. Externally, they are dark coloured and black: their surface is rough, and frequently three furrows may be perceived in them, which run from end to end. Their outward end is always larger than that which adheres to the chaff. That larger end is sometimes split into two or three parts. It is not unusual to perceive some cavities on their surfaces, which look as if made by insects.

3. When the distempered grain is broke, there is in the middle or centre of it a whitish flour, which is covered with another kind of flour of a redish or dark colour. This distempered flour falls to pieces between the fingers. M. Aimen has sometimes found it almost as black as the powder of smutty wheat.

4. These grains being put into water, swim at first, and afterwards fall to the bottom. If chewed, they leave a bitter relish on the tongue.

5. The chaff appears sound, though what is outmost is of a darker colour than when the grain is sound.

6. All the grains in an ear are never distempered at once. They stick less to the husks, than sound grains do.

7. M. Aimen imputes this distemper to the grain's not being impregnated; and therefore what is said of the *charbon* in wheat, may be applied to the *ergot* in rye.

Both M. Tillet and M. Aimen are of opinion that other plants, besides rye, are subject to this *ergot*. M. Tillet asserts, that he has found some grains of wheat attacked with this distemper. If so, they are two different distempers, not to be confounded together. What seems still more to establish this difference is, that, by M. Tillet's experiments, the distempered substance of the rye is not contagious.

M. Tillet seems to think that the *ergot* is occasioned by the sting or bite of some insect, which turns the rye into a kind of gall.

Several physical writers give many instances of people who have been seized with diseases, by eating, for their constant food, in some years, bread in which there was much of this distemper'd rye.

As the distemper'd grains are larger than the sound ones, it is easy to separate the greatest part of them by sifting. It is what the country people do, when corn is not dear: but in times of great scarcity or dearth, they are loth to lose so much grain. It is then that they are apt to be attacked with a dry gangrene, which mortifies the extreme parts of the body, so that they fall off, almost without causing any pain, and without any hemorrhagy. The Hotel-Dieu at Orleans has had many of these miserable objects, who had scarce any thing more remaining than the bare trunk of the body, and yet lived in that condition several days.

As it is not every year that the distempered rye produces these dreadful accidents, Langius is of opinion that there may be two kinds of this diseased rye; one which is not hurtful, and another which occasions the gangrene. It is however probable, that there is but one kind, and that it does no hurt, first, when sufficient care is taken in sifting the grain; and, secondly, when only a small part of the rye is distempered. It is also said, that the rye loses its bad quality by keeping: in which case, the reason why the peasants are attacked with the gangrene in years of dearth, may be, because they consume their crop as soon as the harvest is over.

CHAP. XVI.

STEEPS were brought very early into use, in husbandry; not only as preservatives against the several distempers of corn which we have been speaking of, in which they are demonstratively of great use; but also with a view to render the seed more fruitful. The Romans, as has been already observed, had their lees of oil, decoction of cypress leaves, juice of house-leek, &c. Lord Bacon was the first who seems to have bestowed any attention on this subject in England. What he did, was rather pointing out the path to others, than determining any thing positive on this head himself. We do not know any author who has yet given us a set of experiments with this view, which have been long enough continued to determine what effects any steeps have towards rendering grain more fruitful.

Van Helmont, and since him the authors of the *maisons rustiques*, have given many receipts for steeps, which they boast greatly of, as increasing the fruitfulness of the seed that is steeped in them. Those who recommend these receipts, advise sowing the corn thinner than usual; generally one third less.—All the experiments in this work will shew evidently, that this one circumstance of sowing thin, will add greatly to the crop. That the comparison may be just, all circumstances should be alike, as to the goodness of the soil, the quantity and quality of the seed, &c.

To satisfy myself, says M. Duhamel, whether or no any benefit does arise from the use of steeps, by way of giving the seed a greater degree of fruitfulness, I tried the following experiment. I infused some good wheat in a lye of dung, mixed with lixivial salts, nitre, and sal ammoniac. I sowed with this grain two beds in my kitchen garden, dug with a spade. One of the beds was sowed very thick, and the other very thin. At the same time I sowed two other beds, exactly like the former, with some of the same seed, not steeped, one thick, and the other thin. At harvest time, the beds sowed with the steeped seed were so exactly like the others, that it was impossible for the eye to distinguish between them.

A gentleman in his neighbourhood followed exactly the directions given in the *maisons rustiques*, in the use of one of their boasted receipts,

ceipts, which is there said to be of such efficacy, that the land need be plowed but once for wheat prepared with it. He did so, and his crop was scarce worth reaping.

M. Peyrol, many years secretary to the intendant of Auvergne, acquainted M. Duhamel, that he had made several experiments in imitation of those mentioned in the Abbé de Vallemont's book. In the month of May 1755, he planted in his garden, which is a hot indifferent soil, four small cabbages, which had only four leaves. In September following, the same cabbages were six feet and a half in circumference. Some plants of red wheat, transplanted into a bed dug very fine in his garden, bore 130 ears a piece, which contained each of them from 40 to 80 grains. Some plants of white wheat, transplanted at the same time, produced 120 ears, each of which had from 30 to 40 grains. Two grains of red wheat, sowed in the same bed, and not transplanted, produced each of them 140 ears, which contained 6000 grains.

Five plants of red wheat, distant from one another six inches, did not branch so well, being too close together: but each of them produced from 40 to 50 ears, which contained from 40 to 60 grains.

Rye, which branches less than wheat, produced from 30 to 350 ears, each containing from 60 to 70 grains.

The barley of that country, which branches little, has however produced from 60 to 80 stalks, though the seed was not steeped in any liquor before it was sowed. — The author of these experiments judiciously observes, that they must be repeated and varied, to make it appear that the great increase is owing to the steep.

This liquor of the Abbé de Vallemont is as follows:

Put into a tub, exposed to the south, one bushel of horse-dung, the same quantity of cow-dung, half a bushel of pigeon's dung, as much sheep's dung, as much ashes, three gallons of small prick'd wine, two pounds of salt-petre, and as much water as will sufficiently dilute the whole, so as to make it thin enough for use.

Every time that any of this liquor is taken out to sprinkle the plants, it is filled up again with water; and as it may be too strong at first, it may be weakened accordingly.

M. Peyrol added to this infusion, frequent digging; for the ground was dug five times between the plants of wheat, and he observed that

that each digging sensibly gave fresh vigour to the plants, and that the stalks, which were six feet high, were not laid.

M. Donat says, he has made trials of these mixtures, from the use of which so much is promised: but he acknowledges that he thinks them of no other service, than to amuse the curious, who do not regret expence. As the authors of them boast that all kinds of soils, whether good, bad, or indifferent, whether well or ill plowed, whether rested or not rested, will produce ten times more than in the common way; M. Donat sowed a large extent of ground, some good, some bad, some well, and some ill plowed, &c. He made the eye himself, was present when the seed was sowed, and took care that no circumstance was neglected. But notwithstanding all his care, his crop was far from answering their promises.

The good, well cultivated soil, produced fine wheat; but not extraordinary in point of quantity. The only advantage was in the saving of the seed.

The poor ill cultivated land, and that which had not been rested, produced very little grain: and the very bad soil, nothing at all. These experiments convinced M. Donat, that the surest means of obtaining good crops, is, to have the ground in good condition. This is the principle on which the new husbandry is founded. It offers nothing marvellous, or contrary to the most ancient precepts of good husbandry.

These experiments of M. Donat's seem sufficient to prove the inefficacy of these pretended secrets. However, experiments of this kind should be continued on a double account; first, to take off a prejudice which seems to gain ground, though it be not founded on any rational principle; and next, to be well assured whether these preparations do produce any sensible effect. Experiments seldom prove useless to careful accurate observers. If they do not always answer the end proposed, at least they sometimes lead the way to other important discoveries.

CHAP. XVII.

Of WEEDS.

PLANTS that grow in any ground, different from those which are intended to be cultivated in it, are called *weeds*.

They exhaust the earth, as much as the most useful plants: nay,

may, they sometimes get the ascendant, and multiply to so great a degree, that a field will almost seem never to have been sowed with corn.

The weeds which are feared most, are, 1. *Cockle* or *darnel*. Its seed is black; but being heavy, and nearly of the same size as the grains of wheat, it is not easily separated from them. Sifting, and throwing the corn at a distance on a large floor, are the best ways of clearing the wheat of it. If ground with the corn, it makes bread look black.

2. *Fox-tail*, the seed of which is somewhat like wheat. This gives bread a bitter taste.

3. *Wild poppy*, or *red-weed*, the seed of which is very small, and sometimes multiplies so prodigiously that it choaks the wheat.

4. *Wild fitch*, which covers the corn when it is laid, hinders it from rising again, and makes it rot.

5. *Dog's grass*, and *colt's foot*, which multiply by their seeds, and extend themselves by their creeping roots, and even by the pieces of their roots which are broke off by the plough.

6. *Melilot*, which gives bread a bad taste; and

7. *Thistles*, and many other weeds, which greatly exhaust the earth.

8. *Charlock*, the young plants of which it will be of advantage to the farmer to be able to distinguish from young turneps, especially in weeding the latter, lest they be reared or plucked up indiscriminately. This can scarcely be done but by the taste, the charlock being hot and bitter, and the turnep mild.

To prevent the increase of weeds, it is proper to destroy them before their seed is ripe. But that is not possible in lands which are plowed in the common way; because they grow with the good corn, and most of them ripening sooner than the wheat, their seeds sow themselves, and the weeds multiply. Neither must we expect to destroy them by resting the land; for their seeds will remain sound several years in the earth. If a field that has a great many poppies in it, is sowed with sainfoin, scarce a poppy will appear the second year: but when the sainfoin is plowed up at the end of even nine years, the poppy frequently appears anew; which can hardly be owing to any other cause, than that its seeds have remained sound in the earth all that time; for very few of them can have been brought from the neighbouring grounds, or in dung.

An experiment which M. Duhamel made, confirms this. He ordered the earth with which a ditch had been filled fifteen or twenty years before, to be dug out, and spread on a piece of plowed land. Several plants, of different kinds from any that were in the rest of the field, sprouted up in the place where this earth was laid. Consequently they were produced by seeds which had remained sound in the earth, during the fifteen or twenty years that the earth had laid in the ditch.

It is partly for this reason, that lands which are fallowed, are plowed thoroughly; and it is certain, that as numbers of seeds shoot up during the fallow, repeated plowings destroy many of them. But there are several kinds of plants, such as wild oats and fox-tail, the seeds of which do not sprout, till they have remained two or three years in the earth; nor will culture make them grow sooner.

Some experiments have been made, which seem to contradict our author here. From them it seems to appear, that the seeds of those plants which he says require to remain three years in the ground, were only buried so deep that they remained sound for many years, and that they will not sprout till they happen to be laid at such a depth as is convenient or fit for their sprouting. Though the increase of weeds may be prevented for several years, by plowing, cutting, pulling them up, &c. yet some of their seeds may be thus brought up by each plowing, till all of them have sprouted, and then the field may be kept quite clear, by care.

It is evident that the repeated plowings of fallow lands, far from destroying these kinds of weeds, serve perhaps only to help their seeds to grow more certainly, when the time of their sprouting is come.

Farmers have not yet thought of a more effectual method to destroy weeds, than by sowing the ground out of season; that is to say, by sowing oats the year that wheat should be sowed. It has been experienced, that, by this means, some kinds of weeds have been destroyed, which, appearing only every third year, never shew themselves but amongst wheat.

But the farmer loses a crop, and has still a great number of weeds to destroy, which obliges him to weed his corn. This is done two different ways.

A number of women place themselves in a row; and holding in their hands a hoe, properly made, they cut all the weeds they see,

such as thistles, blue bottles, poppies, &c. If these weeds are very young, they frequently escape the eye of the weeder; and in that case the hoeing must be repeated when they grow bigger.

But the smaller weeds, which are at least as hurtful, such as wild-fitch, wild oats, cockle or darnel, knot-grass, fox-tail, and all young poppies, remain in the field.

Besides, in cutting the weeds, it is scarce possible not to cut down the corn: and the roots of the thistles and other biennial plants which are cut, produce two or three new stalks instead of the old one; by which means the evil is increased.

The other method of clearing corn, is hand-weeding it. This is seldom practised by farmers, because it is too expensive. In vineyards indeed, women who have cows to feed, are glad to have leave to pluck up the weeds for them. But in pulling up those weeds, they likewise pull up a great deal of corn, and what with that, and with their trampling, and dragging their bags of weeds over it, they do more hurt than good; especially if the earth is moist.

The surest way to destroy weeds, is, to continue plowing whilst the corn grows: but this can be done only in the new husbandry.

Weeds may be distinguished into four kinds: 1. Into such as have creeping perennial roots. 2. Such as grow in cold wet soils. 3. Such as are of a large succulent body; and, 4. Such as having small seeds, or that ripening before the corn, sow themselves. Each of these require different methods, to destroy them.

The first can only be destroyed by repeated summer fallows, by which their roots are cut, and turned up to be withered by the sun and winds; after which they are dragged out by harrows, and should be burnt. This repeated as often as the farmer can conveniently during a dry season, or repeated another season, can scarcely fail to complete the cure. *Colt's foot*, which is propagated by the root, may likewise be destroyed by sowing the ground with rye grass, or any plant which, coming up early in the spring, shades and smothers it, whereby it dies in a few years.

The second are destroyed by draining the earth of its superfluous moisture, and by warming it with lime, ashes, gravel, shelly sea-sand, &c.

The third are destroyed by cutting them down when in full sap and vigour: for the sudden interruption which this gives to the motion of the sap, causes it to stagnate in the roots, and putrify there.

there. Some few and weak lateral shoots may be made; but they too being cut in the same manner, the roots are entirely putrified by degrees, and, instead of annoying, become a manure.

The fourth can be destroyed only by frequent fallows, and constantly cutting, or rather plowing them down before they run to seed. Some, for instance the wild oats, may be mowed for hay, but it is much more beneficial to the land to have them turned down; for by that means, instead of being exhausted by frequent crops, it is manured by those enemies to useful grain.

Banks and hedges should be kept free from weeds; not only to preserve their bottoms thicker, but also to prevent the seeds of weeds from being carried into the adjacent fields, by winds, by which means the corn must be constantly pestered with them.



A PRAC-



A
PRACTICAL TREATISE
OF
HUSBANDRY.

PART II.
EXPERIMENTS *and* REFLECTIONS *relative to the*
NEW HUSBANDRY.

CHAP. I.
EXPERIMENTS ON WHEAT.
SECT. I.

Experiments made at Denainvilliers and Acou, in the Year 1750.



R. Duhamel begins his account of the advantages of the new husbandry, with experiments made on small pieces of land. The two first which he mentions were made with great care, one under his own eyes at his brother's estate called Denainvilliers, and the other under the eyes of his neighbour, M. de St. Hilaire.

The more easily to compare the produce of the new husbandry with that of the old, M. Duhamel took two acres of land, situated
in

in the same field, plowed as usual for wheat, and divided into two equal parts, by a furrow; so that the quality of the soil in each acre was perfectly alike.

One of these acres was sowed in the common way with 10 bushels of dry grain, weighing 210 pounds, which, after being steeped, and sprinkled with lime, filled 12 bushels, and weighed 252 pounds.

The other acre was sowed with the drill plough, in the following manner: first, a border of two feet was left unsowed; then three rows of wheat were sowed in a bed two feet wide; after which another space, four feet wide, was left unsowed. This space we call the *alley*. The beds, of three rows of wheat each, and the alleys, were thus continued alternately till the whole was finished.

As the grains of wheat were sowed in the rows at the distance of four, five, or six inches from each other, two bushels, or forty two pounds of wheat steeped and limed, were more than sufficient to sow this acre; by which a saving was already made of ten bushels or two hundred and ten pounds of wheat, which would have been used in the common husbandry.

This acre was sowed so thin, that, during the winter and the beginning of spring, it had more the appearance of ground only plowed, than of a field which had been sowed; whereas the other looked as green as a meadow.

In the spring, he visited the rows, and pulled up the plants where they grew too thick, so as to leave at least four inches distance between each. The alleys were first stirred with the horse-hoe.

This horse-hoeing had a wonderful effect: the wheat became of a deep green, pushed forth large blades, and branched greatly; so that by the middle of May the earth between the rows was quite covered, and the wheat was higher than that of the other acre, which, in comparison of this, was of a yellowish green. When the wheat of the rows began to spindle, it was almost as high again as the other. The alleys then received their second hoeing.

He plucked up at this time some of the most thriving plants of the wheat sowed in the common way, and found that each grain had produced no more than two, three, and very rarely four stalks capable of yielding ears. Many grains had even produced but one stalk, of which numbers were very weak, and seemed choaked by the rest.

Each

Each grain of wheat in the rows, on the contrary produced eight, twelve, fifteen or twenty stalks, almost all of them strong and fit to bear large ears.

The wheat in the common way was in full ear, before one appeared in the rows, in which nevertheless the wheat was taller, and still of a deep green.

As soon as the wheat of the rows was in ear, it was horse-hoed a third time, and continued growing taller as the ears appeared. It blossomed, and the grain formed extremely well: but it was still very green when great heats came on, which ripened it suddenly, and prevented its farther increase, which would otherwise have been considerable.

The crop would certainly have been more plentiful, had it not been for this untimely heat: yet, contrary to expectation, the grain was not *parched*; but proved larger and better filled than that of the other acre.

The wheat was sowed at Acou, as at Denainvilliers: the hoeings were repeated in the same manner; the progress of the wheat sowed in both ways was alike; and lastly, the great heats accelerated too much the ripening of the wheat in the rows, at Acou, as at Denainvilliers.

Result of the Experiment at Denainvilliers.

The arpent which was plowed and sowed in the common way, had been very well dunged; and the other, which was cultivated according to the new husbandry, had received no dung at all. This should make some difference in their products. Let us compare them.

The acre which was cultivated according to the new husbandry produced 284 sheaves: the other 476. It is proper to observe that the quantity of fodder was not in proportion to the number of sheaves; because the straw which grew in the rows was much longer than that of the other acre.

The acre sowed in rows, yielded 70 bushels of large wheat, weighing 1470 pounds.

The other yielded 98 bushels of smaller wheat, which weighed 2058 pounds.

Thus the field which was cultivated in the common way produced 28 bushels, or 588 pounds more than the rows. But it must be remembered, that only two bushels or 42 pounds of wheat were employed

ployed to sow the rows; whereas 12 bushels or 252 pounds were used to sow the other acre. Ten bushels, or 240 pounds, should therefore be deducted from the produce of this last, which will then exceed that of the rows only by eighteen bushels, or 372 pounds.

The expence of dunging an acre, is equal to the value of twenty bushels of wheat when it bears a middling price. This already brings the produce of the acre sowed in rows, at least to an equality with that of the other acre. But a very considerable advantage of the new husbandry yet remains to be considered.

The value of the produce of an acre in the common way, can, in three years, be only equal to the value of one crop of wheat and one third of a crop; because a crop of oats is reckoned equal to but one third of a crop of wheat: therefore the produce of three years will be only 130 bushels and two-thirds; whereas the acre, cultivated according to the new husbandry, will yield three crops of wheat, which, supposing them equal to that of the first year, will amount to 210 bushels in the same space of time. The increase is thus one-third greater, besides the saving of dung.

Result of the Experiment at Acou.

In this experiment, both the acres were dunged; as well that cultivated in the new way, as that in the old.

The acre cultivated in the new way produced 150 bushels or 3150 pounds.

The acre cultivated in the old way produced 133 bushels and one-third, or 2800 pounds. Thus the produce of the former, exceeded that of the latter by 16 bushels and two-thirds, or 350 pounds; which make a clear gain of one-eighth: to this must be added eight or ten bushels saved in the seed: the profit will then amount to 24 bushels and two thirds; or 518 pounds. On calculating the produce of the two acres for three years, it will be found, that the acre cultivated in the old way will yield but 177 bushels and seven-ninths; whereas the acre cultivated in the new method will produce in three years 450 bushels. Thus, besides the saving of the seeds for oats, there will be in three years a clear profit of 272 bushels and two-ninths. A vast advantage in favour of the new husbandry.

As we have already, in treating of the diseases of corn, mentioned the causes which make it most liable to be lodged, we shall here pass them over, and only observe, that, in confirmation of the opinion

opinion already given, M. Duhamel saw with pleasure, that tho' the corn was lodged in several fields near that where the experiment was made, the wheat which grew in rows escaped being laid, notwithstanding the length of the stalks, and the largeness of the ears which were very full of grain. It may therefore be hoped, that by following the new method, there will be less danger of this accident, which sometimes robs the farmer of the finest part of his crop. M. Duhamel wishes he could promise as much for its preventing the blight in wheat: but this seemed to affect equally both that which was sowed in the common broad-cast way, and that which was planted in rows. 'Tis true, that fewer of those blighted plants remained in the rows, because the husbandman, by means of the alleys, easily picked them out.

A farmer at Acou, observing that the chief hopes of more than common success by means of the new husbandry, were founded on the frequent stirring of the ground while the wheat was in it, and on allowing each plant sufficient space to extend its roots, and thereby collect the more nourishment; tried an experiment which appeared to him very proper to discover whether the effect would answer.

He carefully cultivated a grain of barley, which grew by chance in his vineyard. This plant, said he, stands distant from any other; it can extend its roots every way; it is in a rich soil, and cannot want for food: by joining frequent culture to these advantages, this plant of barley, according to the principles of the new husbandry, ought to yield a surprising increase. His reasoning was just, and the experiment confirmed it; for this single grain of barley produced two hundred ears, and about thirty stalks which had no ears. Some of the stalks were four feet high, and most of them three. M. Duhamel counted 24 grains in a middling ear. Thus one grain, planted in a good soil, and well cultivated, produced 4800 grains; and the straw of this single plant of barley, makes of itself a sheaf, which M. Duhamel has in possession.*

It is proper to observe, that, in these experiments at Denainvilliers and Acou, we have followed M. Duhamel's computation, which is, by the French bushel, weighing 21 pounds of wheat; equal to very

* Similar to this is the purport of a letter which M. Duhamel received from the reverend Dr. Hales, informing him, that a grain of barley, which Mr. Hallier planted in his garden in the year 1720, produced an hundred and fifty-four ears, which contained 3300 grains: these he sowed the next year, at the distance of three inches from one another: they yielded him somewhat more than a bushel; which, being sowed again, produced the third year, forty-five bushels and a quarter.

near one third of the English bushel. The French bushel for oats is double that for any other grain.

SECT. II.

M. Duhamel continues his Account of the Experiments at Denainvilliers Acon, in the Years 1751, 1752, 1753, 1754 and 1755, to the following Effect:

I. At Denainvilliers, in the year 1751.

THE alleys of the acre cultivated in the new way, and of which we spoke in the foregoing section, were sowed in October 1750, with wheat, in rows, as before; and the beds on which the wheat grew the former year, were now turned into alleys. The other acre, cultivated in the old way, not being in a condition to bear a crop of wheat in 1751, the owner, satisfied with the produce of the other acre, sowed this with spring-corn, in beds, in order to prepare the ground for wheat in October following. He dunged the beds before the spring corn was sowed, and the crop was a very good one for the year.

Both these acres, which were now cultivated in the new way, were bordered on each side by two pieces of ground of equal extent and like quality of soil. They were both in fine tilth, well dunged, and sowed with wheat in the common way. By this means M. Duhamel was properly enabled to carry on his comparison; the owner having promised to keep the crops of each of these spots separate, and to give him an exact account of their produce. He confesses indeed, that of these two pieces of ground, that which he chose to make his comparison by, was somewhat better than the other, which may of course seem to diminish the advantage of the new culture.

The cold rains which fell during all the spring and summer of this year, greatly damaged every production of the earth, and especially wheat. It is therefore no wonder if the produce of his experiment was much less this year than the last. It is enough for our purpose, that the new culture still preserved the same advantage over the old, that it did the year before.

At the end of spring, and during the whole summer, the wheat of the rows was much taller, and of a livelier green than that which was cultivated according to the old husbandry; and tho' the grains produced but 3, 4, or 5 stalks a-piece, instead of 8, 12, 15, or 20, which they yielded the year before, yet they branched more than what was raised in the common way.

At harvest, the rows were free from weeds, and tall enough to be reaped; whilst the wheat sowed in the common way, was so short and full of weeds, that it was obliged to be mowed, and the weeds to be dried, like hay. Each of these fields produced 336 sheaves. This is very different from the product of the year before, when a single acre cultivated in the same manner, yielded 476 sheaves.

In this year's experiment, the acre which yielded 70 bushels, or 1470 pounds of wheat in 1750, yielded now but 40 bushels or 966 pounds of good wheat free from smut.

The other acre which was cultivated in the old way, and had been well dunged, and which produced 98 bushels, or 2058 pounds of fine wheat in the year 1750, yielded this year but 38 bushels and a half, or 808 pounds and a half of small wheat, above a third of which was blighted and smutty.

We see by this account, 1. That the acre cultivated in the new way, yielded this year 504 pounds less than in 1750.

2. That the acre cultivated in the old way, produced 1249 pounds and a half less than in 1750.

3. That the acre cultivated according to the new principles in 1751, produced 157 pounds and a half of fine clean wheat, or near one fifth, more than the acre cultivated in the common way, which yielded only a small grain, mixed with a great deal of smut.

4. We must not forget that 12 bushels of wheat, French measure, were employed to sow the acre which was cultivated in the common way, and that not quite two of the same bushels were used in sowing that which was cultivated according to the new husbandry. The difference of 10 bushels, or 210 pounds of wheat thus sowed, must consequently be added to the 157 pounds which this acre produced more than that with which it is compared. The gain is therefore 367 pounds.

5. This is not all. The wheat of the rows was choice corn, very fit for seed, and sold for a third part more than that which was cultivated in the common way, which was of a very small grain, extremely smutty, and full of seeds of weeds.

Where we said, that the wheat of the rows was not blighted or smutty, we would not be thought to impute that wholly to the new culture. The care which the owner took from time to time, to pluck up the faulty ears as fast as they appeared, contributed greatly thereto; though it is certain, that even if he had not taken that

pains, his wheat would have been much cleaner than that of the neighbouring field.

M. Duhamel mentions a slip of land, which was too narrow to be formed into beds, and on which the owner was notwithstanding willing to try the new culture. He made it into one large bed, in which he sowed six rows of wheat, and horse-hoed the vacant ground on both sides. He hoped that six rows would be as much benefited by the hoeing, as three: but he was mistaken; for, at harvest, the two outside rows were very fine, the next to them were inferior, and the two middle rows were no better than the wheat in a common field.

II. *At Acou, in the year 1751.*

THE spot of ground, which was cultivated at this place according to the principles of the new husbandry in the year 1750, yielded, as we observed before, 150 bushels an acre; and the other spot, which was cultivated in the common way, yielded at the rate of 133 bushels and a half. The first spot, which was not dunged, produced 83 bushels and one third in 1751. This year's crop fell consequently 66 bushels and two thirds short of the preceding year's. The owner was however well satisfied with this crop; for the land in the best tilth and best dunged in the common fields, having produced but 48 bushels an acre, he had a profit of 27 or 28 bushels, including the saving in the seed.

SECT. III.

Continuation of the experiments at Denainvilliers and Acou, in the year 1752.

I. *At Denainvilliers.*

THE same acre which was at first cultivated in our new way, was again sowed with wheat this year, and without being dunged.

It now produced but sixteen French bushels. This may be partly imputed to hail that fell on the 10th of July, which greatly damaged this spot as well as all the neighbouring fields. But, independent of this accident, it must be owned that the corn never promised well. It was rusted whilst in blade, like that of all the other fields; but the rains which fell towards the end of July; and the hoeing which it received at that time, quickened the vegetation: the plants which had not branched at the proper season, made fresh shoots,

shoots, and produced small ears, which were too backward to ripen, because there was a necessity of cutting down the whole when the grain in the principal ears had attained its full growth.

M. Duhamel thinks that several reasons may be assigned for this accident. 1. The seed was sowed late; whereas it should, according to the new method, certainly be sowed early. 2. As the alleys were cultivated by hand, the owner contented himself with destroying the weeds by a slight hoeing, as is done in gardens: hence arose this double inconveniency; that the wheat then growing was not well cultivated, and the soil was not sufficiently prepared for the ensuing crop. 3. The variety of business necessary to be done in the common field, which frequently prevents many things being performed at the proper season, and the not being able to horse-hoe this spot early enough in spring, hindered the plants from branching so much as they might otherwise have done. This observation shews the importance of hoeing at the proper seasons; and will more fully appear hereafter, from M. de Chateau-vieux's experiments.

II. *Experiment made at Denainvilliers, in order to know whether it be most profitable to sow in two rows, or in three.*

It is not yet determined, says M. Duhamel, continuing his experiments, whether it be most profitable to sow, as we have hitherto done, three rows at seven inches distance from one another, leaving the alleys four feet wide; or to sow only two rows in each bed, allowing but three feet for the alleys.

To know by experience which of the two ways would be best, we sowed a field, partly in three rows, and partly in two.

This field was reaped the 8th of August, tho' the corn was not quite ripe, because it would otherwise have been eaten up by birds. We therefore, continues he, cannot say whether the two rows or the three would have produced most in proportion. All that could be done was to make the following observations:

An equal number of sheaves, and equally large, was gathered off from each.

The straw of the two rows was much longer than that of the three rows, and the ears of the two rows were much the biggest and longest.

All who saw the field, believed there was at least as much corn, if not more, on the beds which had but two rows, as on those which had three.

III. Continuation of the experiment made at Acon in the year 1751 and 1752.

THE same spot of ground continued to be cultivated according to the new principles, without dung, and yielded this year after the rate of 70 French bushels an acre.

Instead of sowing, according to the usual way, twelve of those bushels of wheat steeped and sined, only two bushels of that measure were used to an acre. The crop may therefore be estimated at least 80 bushels of very fine wheat.

The owner of this spot had no ground sowed this year in the old way, with which a comparison could be made: but he was well satisfied with his crops, which yielded him at least forty for one.

SECT. IV.

Experiment made at Denainvilliers in the year 1753.

THIS ground was badly cultivated in the year 1752, as we observed before, and the crop suffered by it. It was now sowed, part with common wheat, and part with Smyrna wheat. M. Duhamel's intention was to try whether this last grain, which requires a great deal of nourishment, and which for that reason does not answer well in the common husbandry, would do better when cultivated after the new method. But this corn, which was sowed too thin at first, sustained a considerable loss before it could be reaped. The singularity of the grain drew numbers of curious people to see it, each of whom gathered at least some ears, and others a quantity, in order to sow it in their gardens. Notwithstanding all these losses, the common and the Smyrna wheat together produced 76 sheaves and one-fourth, an acre, which yielded 500 pounds of fine corn. Forty-six bushels, weighing 960 pounds, are reckoned a good return from an acre of the same kind of soil cultivated in the common way; from which must be deducted at least four bushels, or 84 pounds, for the extraordinary quantity of seed employed in that way. The produce of an acre cultivated in the common way is hereby reduced to 876 pounds: but none yielded near so much this year. However, supposing the crop of the acre cultivated according to the new principles, to be less than that of the other by 380 pounds; still it will be found that the produce of the field cultivated in the common way will amount to no more than 1173 pounds in three years; whereas even on the footing of this diminished crop, the acre cultivated in the new way will produce 1488 pounds of wheat in that space of time.

SECT.

S E C T. V.

Experiment made at Denainvilliers in the year 1754.

THE alleys having been very well stirred last year with the hoe-plough, there was reason to expect a plentiful crop this year, tho' the seed was sowed somewhat late. It produced about 50 French bushels and a half, or 1060 pounds of wheat an acre; which was a good return for the kind of soil on which the experiment was tried; especially if at least 60 pounds saved in the seed be added to it.

What ought not to be omitted is, that half the crop consisted of Smyrna wheat, and that it had not degenerated in the three years that it had now been cultivated according to the new husbandry.

S E C T. VI.

Experiment made at Denainvilliers in the year 1755.

OF the two fields which had now been cultivated for seven years, according to the principles of the new husbandry, one, which was badly plowed in 1754, yielded but an indifferent crop. That of the other field was good. In 1755, M. Duhamel says he had reason to be satisfied with the products of both these fields, compared to the other crops of wheat in the same country, which, in general, yielded but very little grain.

S E C T. VII.

Experiments made by M. Diancourt, captain aid-major to the regiment of French Grenadiers, in the years 1753, 1754 and 1755.

IN the beginning of November 1752, M. Diancourt sowed, according to the new method, six perches of land, at 22 feet to the perch, with Flanders wheat. As only three or four grains of it came up, he sowed the same spot again, towards the end of November, with common wheat, which rose well and throve perfectly.

As M. Diancourt had sowed only two rows of wheat, which took up about six inches in breadth, and had left alleys six feet wide between his rows, he justly regretted that only a thirteenth part of his ground was occupied; and, in order to employ it to more advantage, he resolved in April to sow a row of barley in the middle of each of those wide alleys.

It

It is proper to observe, that this ground, being of a nature not to retain wet, had no winter plowing; nor was it plowed in the spring, because the alleys seemed to be clear of weeds: but, as M. Diancourt himself acknowledges, this last plowing is of consequence, because it gives the corn fresh vigour, and begins to prepare the earth for the next sowing. However, the barley grew very well; but there was a necessity for pulling it up towards June, in order to plow the alleys; because the wheat had branched so much, and its blades were grown so long, that, covering the ground from 18 to 24 inches round, the horse was obliged to go almost in the middle of the alleys, that the share, which followed in a parallel direction, and at a small distance from the rows, might turn the earth up towards them, and lay new mould about the plants.

The tufts of wheat had from 20 to 93 stalks; and most of them from 40 to 72. What made these plants so very fine, was, that their roots could extend themselves freely in the alleys which were very wide, and in the rows where the seed had been sowed very thin: but at the same time a great deal of ground was lost, as M. Diancourt observes.

The evening before St. John's day, a violent hurricane beat down all the plants of this experiment, without breaking scarce any of the ears. A spot of ten perches, which could not be cultivated with the plough, but had been dug twice with the spade, and looked very fine on the 15th of April and 10th of May, was hurt more than any other part. But the damage was repaired in 24 hours, by hand-hoeing fresh earth round about the plants. This had so good an effect, that they were not at all injured by a very high wind which blew some time after.

M. Diancourt, from the beginning of spring, always turns the earth up towards the rows. This is attended with three advantages. 1. The new mould gives additional nourishment to the wheat. 2. It supports the plants, and prevents their being laid so easily as otherwise they might. 3. This operation forms a large furrow in the middle of the alleys, which being filled up after harvest, and the bed then made over that furrow being raised high and arched above the level of the ground, the next sown plants have an excellent depth of mould to strike their roots in.

The wheat of this spot had begun to blossom before the hurricane on the eve of St. John; and within a week after it was hoed, M. Diancourt was greatly surprised to see it all in full bloom, and so full

of

of sap as to nourish and bring to maturity several little ears from which nothing was expected, and which nevertheless grew four inches long. Unluckily those small ears did not ripen till after the large ones, many of which were seven inches long, and one of which contained 101 grains.

One perch of 22 square feet produced 18 pounds 13 ounces of fine wheat. If we multiply this quantity by 10, to have the produce of the whole spot of ground, or by 100, to have that of an arpent, (which is equal to an acre and very near three quarters of a rood, English measure,) we shall be surprised at the plentifulness of this crop, reaped from a field in which so much ground seemed to lay useless. M. Diancourt says, that the lands of his farm produce one with another, from five to eight *septiers* an arpent, that is to say, from 20 to 32 English bushels; and as the *septier* weighs about 260 pounds, it follows that the common produce of a perch is at most 20 pounds, which is much less than lands cultivated in the common way sometimes produce. M. Diancourt having cut down a square perch of wheat, so extremely fine that it was the admiration of every one, it yielded him 32 pounds of grain. As the farmer had sowed this perch with two pounds and a half of wheat, and M. Diancourt sowed at most but half a pound, the real produce of the perch was 30 pounds. Now as all that this farmer can expect from his land in three years is, one crop of wheat, and one crop of spring corn, which is valued at a third of the crop of wheat; he can have in three years no more than the equivalent of 40 pounds of wheat: whereas Mr. Diancourt, who reaped but 18 pounds thirteen ounces, deducting the seed for three years, after the rate of 8 ounces a year, which is one pound eight ounces in all, will have remaining neat for his three crops 51 pounds 15 ounces, which is 11 pounds 15 ounces more than the farmer's crop. To judge rightly of the advantage of the new husbandry, it must be observed, 1. That M. Diancourt says he chose the finest perch in forty arpents of land, to make his comparison by. 2. That he tells us his alleys were too wide. 3. That the seed of the oats is not reckoned in this calculation. If, with all these advantages on the other side, the profit was one fifth in his favour, how much greater would it have been supposing a parity of circumstances?

M. Diancourt likewise sowed three other spots with wheat, *viz.* one of 12 perches and a half, another of 10, and a third of four. The alleys of these three spots were plowed in the beginning of May. The plants here suffered much less by the hurricane, than those we

spoke of before: their stalks were only bent; but so much indeed as to hinder the plough from passing in the alleys. To remedy this, M. Diancourt ordered them to be earthed-up with a shovel, and then the plough was able to work. 'Tis true this did not re-instate them so well as the husbandman had done those in the last mentioned piece of ground: but however, they kept upright till the third and last plowing, which was given towards the end of July.

The finest tufts on these grounds had not above sixty stalks; but on the other hand very few had less than twenty. M. Diancourt says nothing farther of these three spots: but he insists strongly on the following experiment which he made with spring corn.

In March, M. Diancourt sowed spring wheat in single rows, three feet asunder, and the grains in the rows at the distance of eight inches from each other. The farmers of that country, surprised at what he was doing, assured him that his crop would never yield above a few pints. To convince them by their own experience, M. Diancourt proposed to one of them to sow after his own way, a square bordering on, and exactly like that which he had sowed in this new way.

From the time of sowing, till within a month of harvest, the farmer's field promised infinitely more than M. Diancourt's, who could hardly persuade himself that he should have even tolerable success, when he compared his 18 little single rows, three feet distant from one another, with the farmer's field which was covered like a meadow. But a little before harvest, the ears of the rows appeared from four to six inches long and very thick; whilst those of the farmer, which suffered by drought, were very poor, and not above an inch or two in length. In short, the farmer who had sowed 34 pounds of grain, reaped neat 126 pounds and a half; and M. Diancourt, who had sowed but one ounce, reaped betwixt 92 and 93 pounds. Thus, the farmer's crop in three years would amount at most to the value of 169 pounds of wheat, whilst M. Diancourt's would be 279 pounds; which is almost double the other.

In March 1753, M. Diancourt prepared two arpents of ground in his park, in order to sow them with wheat the next September: and that this ground might not be useless during the six intermediate months, he laid it out in beds, in June, and planted them with beans, some in single and others in double rows; the beans being a foot asunder in those rows. In the beginning of October, an immense quantity of beans was gathered off this spot. The single
rows

rows produced as many as the double ones. Some stalks had upwards of 180 pods.

This prodigious fertility can be ascribed to nothing but the good culture of the ground; and is a strong proof that the great success which many have imputed to the effect of certain mysterious steepers or infusions, has in fact, been owing solely to the goodness of the soil and the proper culture of it.

In order that plants raised according to the new principles may enjoy the benefit of the culture of the alleys, their roots must be able to extend themselves to a pretty considerable distance. This reflection made M. Diancourt take up carefully some of his plants of beans and wheat, to examine their roots.

The roots of the beans extended, in general, upwards of three feet from their stalk. Almost all the roots of a grain of wheat which had produced 93 fine ears, were from 15 to 18 inches long; but instead of spreading horizontally, like those of the beans, they shot down perpendicularly. From hence it may be concluded, that it is needless to make the alleys six feet wide; but highly proper to give the beds the greatest depth of loose mould that the staple of the soil will admit of, either by plowing deep, or raising the earth high where the rows are to be planted.

M. Diancourt sowed eight perches of land, with oats, in double rows, and alleys six feet wide. The most prejudiced against the new husbandry were forced to own, that two of his rows produced more grain than the whole eight perches would have done if sowed in the common way.

There are two kinds of insects in M. Diancourt's grounds, which gnaw the roots of wheat. Our gardeners call one of them the red worm: the other is the millepedes or Scolopendra. M. Diancourt has begun experiments in order to try whether they cannot be guarded against by earlier or later sowing of the ground that is infected with them. The event of these trials, which M. Diancourt justly looks upon as very interesting, is yet uncertain: but M. Diancourt observing one day a tuft of wheat which languished, judged that its roots were preyed upon by these insects. To satisfy himself therein, he pull'd up the tuft, and found a worm in it. He then cut off half the length of the leaves and roots, planted the tuft again, and watered it, because the earth was extremely dry. The tuft grew very well, and produced 12 perfectly sound ears, four inches long.

M. Diancourt varied his experiments for the next year, by sowing

in single, double, and triple rows, some very early, and others very late. He could not attend the progress of these trials himself, being called away to the army: but the result, as he informed M. Duhamel, was, that he was convinced that corn planted in the new way is much less liable to be lodged than what is sowed in the old. With regard to the advantage of sowing very early, to be satisfied in which M. Diancourt sowed some rows the 9th of August, and others the 1st, 5th, 10th, and 15th of September, he observed, that the rows which were sowed the 9th of August, spindled but five days earlier than the wheat in the common way, and that the ears were but midling: nor did the rows which were sowed the 1st, 5th, 10th, and 15th of September spindle much sooner than other common wheat; and a spot sowed in single rows, produced as much as the same extent of ground sowed in double and in triple rows.

From these experiments, M. Diancourt was tempted to conclude, 1. That the right season for sowing is in the month of September, and the beginning of October. 2. That it is more profitable to sow in single rows, than in double or triple ones. However, he would not, said he, pretend absolutely to determine these points, till he should have had at least three years experience.

One of the pieces of wheat from which M. Diancourt expected most, and which in fact promised greatly at first, suffered a sudden and almost total change, the plants decaying visibly from day to day. Surprised at this accident, he ordered the whole spot to be turned up in his presence, in order to discover the cause; when he found the whole length of the ground immediately under the rows, hollowed by moles and field-mice, drawn thither, in all probability, by some remaining roots of turneps with which that ground had been planted the year before.

Mr. Diancourt continued his experiments in the year 1755, in the same manner as before, and with still greater success.

SECTION VIII.

Experiments made by M. DE LA CROIX, at Verdun on the Meuse, in 1755; extracted from a Letter of his to M. DU HAMEL.

"IN the year 1755, says M. De la Croix, being convinced of the solidity of the principles of the new husbandry, I desired M. de Chateau-vieux to buy me a drill-plough. I received it, well conditioned,

tioned, towards the end of July, and sent it in September to Hermeville, a village about nine miles from Verdun. I agreed with the farmer of an estate which I have there, for three arpents of land, on which I purposed to make my trials.

This spot had received the usual plowings in the common way, I divided it into four almost equal parts, one of which I destin'd to be sowed in the old way; the second, to be sowed in equally distant rows with the drill-plough; the third, to be laid out in beds five feet wide; and the fourth, in beds of six feet.

I was present whilst the first four or five beds were made; and after marking out the others, left the finishing of them to my farmer, not imagining he could mistake: however, he did; so that I had in all twenty-five beds, viz. but three of six feet, and twenty-two of five feet.

We sowed the next day, which was the fifteenth of September, the weather being very fine. We began with the beds, twenty-two of which were sowed with three rows, and three with six. These beds took up an arpent and an half of ground, and 21 pounds, one ounce and two pennyweights of seed.

Immediately after, I sowed in the common way the spot prepared for that purpose, with 63 pounds, 4 ounces, and 2 pennyweights of seed.

Whilst this part was harrowing, the third spot was sowed in equally distant rows with the drill-plough, and took up 25 pounds, 5 ounces of seed.

All these operations were performed in three hours and an half. I was surpris'd at the ease with which they were executed, considering that this was the first time we had used, or even seen a drill-plough. The only fault I found in it, was, that it bruised and ground some of the grains. However, my ground was sufficiently stock'd with plants, excepting the part that was sowed in equally distant rows, in which there were here and there some chafms, occasioned by our not having kept the drill in a parallel direction in some places.

Some time after, I gave directions for making a small plough with one wheel, to turn up my alleys. Unfortunately, this instrument could not be got ready before the rains which began in October; so that I could not give the latter plowings which I intended. However, only two or three of my beds suffered at one end, where the ground had not slope enough for the water to run off.

"The

The arpent contains 48400 square French feet, which are equal to 51691 English square feet, or to 1 acre, 29 poles, 9 paces, 1 yard, and 2½ square feet of our measure.

"The month of March being likewise very rainy, and not having leisure to go into the country, my alleys still remained without culture, which they received for the first time the twenty-first or twenty-second of April, with my small plough.

"A month after, that is to say, about the twentieth of May, my alleys were plowed again with the cultivator. This was of great service to the ground, by breaking the clods which my small plough had left in April. From this time, I conceived great hopes: my plants branched out considerably; their blades grew very large, and of a deep green; whilst the wheat in the neighbouring fields was poor and stunted, and of a yellow green.

"I could not possibly give my alleys any other plowings after May, by reason of the rains which were almost continual.

"In the beginning of August I visited my corn, which did not yet seem thoroughly ripe; especially that of the beds; but it was incomparably finer than the neighbouring wheat; the stalks were much stronger, taller, and more vigorous than any in the common way, and the ears at least twice as long and well filled. I judged that they would require a fortnight more to ripen them: but a few very hot days made them turn yellow, and they were reaped at the same time as the other wheat of the country.

"I say nothing of the rains which hurt the harvest, nor of the quantity of weeds which the wetness of this year produced in all lands, and particularly in the best. Like others, I had a great many weeds in my ground; but the strength and tallness of the wheat in the beds, and in the part that was sowed with the drill-plough, got so far the better of those enemies, that the crop suffered little by them.

"The part sowed in the common way, and for which 63 pounds, 4 ounces, and 2 pennyweights of seed was used, yielded 480 pounds of grain, after deducting the tythe: consequently the neat produce was 417 pounds. The products of other parts of this field (the tythe likewise deducted) were as follows. The spot sowed in equally distant rows, with the drill-plough, and with 25 pounds 5 ounces of seed, yielded at least 500 pounds of grain, and would certainly have produced more, had it not been for the mismanagement of the drill-plough, which I mentioned before. The neat produce here, was therefore 474 pounds, 11 ounces. The beds which were sowed with 21 pounds, 1 ounce and 2 pennyweights of seed, yielded 660 pounds; and for their neat produce, 638 pounds, 14 ounces.

"I suppress all the reflections which naturally occur in favour of these

these trials, imperfect as they were: but to prove still more how advantageous it is to sow the seed at sufficient distances, I shall mention a little experiment which I made in my garden. I planted in a bed, about thirty grains of wheat, seven or eight inches distant from one another. Each grain produced its plant, which I cultivated carefully at the proper seasons, and particularly in the spring: that is to say, I gave the earth round these plants a good stirring, before they branched, before they spindled, and before and after they had blossomed. They grew so prodigiously, that one would scarcely have taken them for common wheat. The stalks were upwards of four feet high, exclusive of the ear; the blades were above two fingers broad; and they remained thus beautiful till the beginning of July, when they were seized with the *rust*. The very day on which I perceived this accident, was excessively hot and sultry, and had been immediately preceded by a very thick fog. This, doubtless, occasioned an extravasation of the sap. I let these plants stand till the grain was thoroughly ripe, and then I plucked them up. Their roots were much longer, and spread a great deal wider than those of any wheat in the common way. I reckoned the number of ears upon each plant, and found that the poorest of them had produced from 35 to 40, and that many had from 80 to 90: three, in particular, had 102, 104, and 105 ears. I counted 42 grains in one ear."

SECTION IX.

Experiments made near Guignes, in the Province of Brie, under the Direction of M. ROUSSEL, in 1755.

M. Roussel prudently began, as we would advise every one to do, with small experiments. His first trial of the new husbandry was upon a little spot: but being prevented from attending to it in person, many faults were committed during his absence. On his return, which was towards the end of November 1754, he inquired after his crop, and learnt, with pleasure, that some grains had produced upwards of 60 ears a-piece, and that many of these ears contained 64 grains. This was sufficient to shew him the excellence of the new culture, which he immediately determined to extend to larger objects.

He had no time to lose. Two contiguous pieces of ground, containing 24 acres, had been folded, and were just going to be plowed

plowed for the last time, in order to be sowed according to the usual practice of the country. These were chosen for the farther trial of the new husbandry, and were accordingly sown with the drill-plough, between the ninth and twenty-fifth of October, with 571 pounds of wheat, including 10 pounds and an half, which were used to fill up some spaces where the seed had missed. This is after the rate of 24 pounds to an acre.

At the same time, an adjacent piece of ground which had been folded like the former, and of which the soil was equal to the best part of the field sowed in rows, was sown in the common way. This last contained four acres and a half, and took up 486 pounds of seed, which is 108 pounds to an acre.

The corn came up finely in both fields: but that which was sowed in rows happened to be near a wood, from which numbers of rabbits came and entirely destroyed the plants of near five acres; the roots which they left, were eaten by worms; and the dung of the sheep-folds produced a great quantity of weeds. This was not all: as the furrows did not run in the direction of the declivity of the ground, the water lodged in them, so that the first plowing, which ought to have been given in March, could not be performed till April, when it left a great many clods.

These clods were grown hard by the time of the second plowing, which was performed with a plough with two mould-boards, which instead of breaking and loosening the ground, and laying fresh earth to the roots, only turned those hard clods over upon the rows.

The third plowing, which was given with a plough with two shares, and in more favourable weather, had a better effect.

Notwithstanding the accidents which had reduced this piece of wheat to so wretched a condition, that the husbandmen said they were sure it never would produce a crop worth reaping, and that all the labour was thrown away: yet, reckoning upon the footing of 24 acres, though it would be but just to deduct the five which were absolutely destroyed by the rabbits; and supposing too, the crops of 1756 and 1757 to be no greater than that of 1755; M. Roussel's calculation proves, that even then these three crops will still be better than what the same field would produce in the common way.

But, says M. Roussel, if we do the new husbandry part of the justice it deserves; and, instead of including the five acres which the rabbits destroyed, we reckon only the produce of 19 acres, pre-

prepared in a hurry, and badly plowed; and even suppose them to be no better managed in the following years, and the whole extent of the 24 acres, to be only of the same quality as the 4 acres and a half with which it was intended to be compared; the produce of both, in three years, will be as follows:

The 19 acres produced 11592 bushels of wheat, which was preferred to any other for seed, not only because it was finer, but likewise because it was quite free from all seeds of wheat. This is after the rate of 610 pounds for every acre.

From this, we are to deduct the seed, which is, for each acre, 24 pounds.

The neat produce of each acre, will then be 586 pounds of wheat, free from all seeds of weeds.

Supposing the crops to be no greater in the following years, tho' what we shall say hereafter will shew that they certainly will, each acre will have produced at the end of three years, 1758 pounds of wheat.

The other piece of ground, which was cultivated in the old way, in order to make the comparison, produced 1260 pounds an acre, from which we are to deduct 154 pounds, for the seed.

The remaining neat produce is 1106 pounds.

The second year's produce of this same acre, sowed with spring-corn, can be reckoned at only half the value of the first year's crop of wheat; and the third year produces nothing, being the year of fallow.

Thus the total neat produce of the acre cultivated in the common way, will be, at the end of three years, only 1659 pounds; whilst that in the new way, will be 1758 pounds.

M. ROUSSEL gives the following Account of his Experiments in 1756.

"IN October 1755, says he, I chose in the middle of a fallow field which had been well plowed, and was not exposed to any of the accidents I met with last year,* a piece of ground, which, to make a fair comparison between the new method and the old, I divided into two equal parts. One of these spots was set apart for the new husbandry; and the other, exactly of the same

* This change of ground was far from being an advantage to the new husbandry, as M. Duhamel observes.

same soil, and quite contiguous, to be sowed broad-cast in the old way.

This last ground was extremely well dunged by folding of sheep upon it. With regard to the other, which was to be cultivated in the new way, and which composed 93 beds five feet wide, including the alleys; only eight of these beds were dunged by sheep, and that at the same time, and to the same degree as the ground by which the comparison was intended to be made: of the other beds, 76 had no sort of dung or amendment whatever; and nine were dunged more or less, in the manner and proportion hereafter mentioned.

“Most of those who practise the new husbandry, use no dung at all. I supposed that their reason for rejecting this manure was, the difficulty of finding a proper time to apply it; for whilst the alleys receive their several stirrings, no wheel carriage can be admitted with dung without hurting the beds which are sown, and hardening the loose mould of the alleys: to carry it on the backs of cattle, would be at best a very difficult, tedious, and expensive way, where any considerable space is to be tilled: to spread it upon the earth only the moment the seed is going to be sowed, is a sure way to clog up the drill-plough, and hinder its operation, if the dung be not thoroughly rotten; and to breed weeds, which by no means suit this culture. To remedy these inconveniences, I contrived the following method. I opened in each of the alleys one of those large furrows, which must always be every year at the end of the summer hoeings, in the place where the three rows of seed are afterwards to be sowed; and by drawing the plough with two mould-boards once through it, I made it 14 or 15 inches wide; which is the breadth that the three rows of seed require. The bed between two of these deep furrows is exactly the breadth of a cart, the wheels of which going in them, hurt no part that has been plowed, and do not press down or harden the loose mould; nor do the horses do any damage, because they necessarily tread upon the stubble of the late reaped beds, in the middle between these two furrows. This was the method I used to dung the 9 beds in question. * The dung was well rotted: it was spread at the bottom of the furrows, and immediately covered over by the same plowing that made the beds which were sowed some days after. Perhaps this manure may be of more service

* This, says M. Du Hamel, is a contrivance of great importance; and I confess, adds he, that I have always been puzzled how to spread dung in the new husbandry.

vice, to my lands than to many others, because the soil is naturally cold and backward. The grain is by this means sowed upon a kind of gentle hot-bed, the warmth of which promotes the branching and vegetation of the plants. The winter rains and frosts, raise a fermentation. The first spring plowing, by giving it a little air, revives that fermentation at the very time when the sap is most active, and the plant begins to branch. As the dung rots, a kind of motion is caused in the earth, which in some measure answers the end of a slight plowing, and brings fresh nourishment to the roots. The same heat which consumes the straw, likewise consumes the little seeds that are in the dung, which might otherwise produce numbers of weeds. When this dung is brought up again to the surface of the earth, by the next year's plowings, it will no longer have those hurtful seeds. It will indeed have lost its heat; but it will still have retained all its fatness, which will mix with the earth; and land thus constantly dunged, will in time become a perfectly fine mould. But if these layers of dung should be spread too thick, or the dung itself be of too hot a nature, the roots of the corn might perhaps be endangered thereby. It was to determine this, that I tried the following experiments, to know the effects of different dungs, and what quantity it is proper to employ.

" Three beds were dunged, in the above manner, with horse-dung: the first, which was 1165 feet long, had three loads of dung; the second, of 1171 feet, had but two and a half; and the third, of 1183 feet, had but two. Three other beds were dunged with cow-dung: one of 868 feet, with two loads and a half; the second, of the same length, with two loads; and the third, of 874 feet, with only one load and a half. The three remaining beds had sheep's dung: the first, of 842 feet, two loads; the second, of 838 feet, one load and a half; and the third, which was of the same length, one load.

" These beds were distributed in such manner, that each of them was in the middle of two other beds which were not dunged. The field, thus laid out, was sowed on the thirteenth, fourteenth, fifteenth, and sixteenth of October, with your drill-plow, which plants three rows in each bed. I used 378 pounds of seed; and afterwards 10 pounds, to fill up the chasms; which is after the rate of 32 pounds 6 ounces to an acre, and consequently a little too much. Accordingly, when the corn came up, I saw it was too thick

sown. The reason was, that the grain was too small, and not proportioned to the out-let of the drill-plough. At the end of ten days this corn rose well. On the eighteenth of December, I observed that most of these plants had branched into four stalks; whilst those in the common way had but three. I perceived no sensible difference then, between the dunged and the undunged beds. It was not till the twenty-fourth of January, that I saw plainly that the plants of the dunged beds were of a deeper green, and had made longer and more vigorous shoots than those of the undunged beds. By the twentieth of February, five smaller stalks issued out of the five great ones, which was not the case with the wheat in the common way. The alleys did not receive their first plowing till the tenth of March. Eleven of the main stalks grew an inch and a half in five days; and I observed that the moles were rather more busy in the dunged beds, than in the others. As the earth was yet somewhat too soft, I thought it needless to continue a plowing which could do no good, and therefore postponed it to the twenty-eighth of March, and following days. On the ninth of April, I found a plant with 18 stalks in one of the dunged beds: the greatest number of branches that any of the plants in the undunged beds had, was twelve: but on the other hand, I likewise found some which had eighteen in the field of comparison sowed in the common way. On the ninth of May, this same plant had 20 stalks; and from that time it branched no more. The second plowing was not given till three weeks after, viz. the twenty-eighth of May; which, I think, was somewhat too late after the corn had ceased to branch. By the twenty-third of June, there were three sorts of wheat in all the beds: there were ears in blossom, others just going out of bloom, and others not yet out of their hoods. The finest ears were those which came up and blossomed first. The most forward beds were those which had been dunged under furrow, with sheep's dung: the next to them, were the eight beds which had been folded, the plants of which were a little greener than those of the undunged beds. The last plowing was given on the tenth of July. The grain had then begun to fill: but that in the common way was the most forward, though it was sowed three weeks later than the other. I know not for what reason, the wheat of the new husbandry began to be reaped the fourth of August, and that in the old way was let stand till the thirteenth. The product of both cultures was as follows:

"In the ground cultivated in the new way, the three beds dunged with horse-dung, yielded,

The first, 1165 feet long, dunged with 3 loads,	19
The fellow to it, not dunged,	15
The second, 1171 feet long, dunged with 2 loads and a half,	18
The fellow to it, not dunged,	14
The third, 1183 feet long, dunged with 2 loads,	16
The fellow to it, not dunged,	13

The three beds dunged with cow dung, yielded,	
The first, 868 feet long, and dunged with 2 loads and a half,	16
The fellow to it, not dunged,	11
The second, likewise 868 feet long, and dunged with 2 loads,	15
The fellow to it, not dunged,	12
The third, 874 feet long, and dunged with one load and a half,	14
The fellow to it, not dunged,	12

The three beds dunged with sheep's dung, yielded,	
The first, 842 feet long, and dunged with 2 loads,	17
The fellow to it, not dunged,	10
The second, 838 feet long, and dunged with 1 load and a half,	15
The fellow to it, not dunged,	11
The third, also 838 feet long, and dunged with 1 load,	14
The fellow to it, not dunged,	10

The eight beds which had been folded, two of which were 1171 feet long, three 1177, and three 1183, produced in all, 142
This is near 18 sheaves apiece.

The 67 other beds, which had not been dunged, produced in all 814
This is somewhat more than 12 sheaves apiece.

Total produce of the 12 acres cultivated in the new way - 8 Sheaves 1208

The 12 acres sowed in the common broad-cast way, after having been well folded all over, produced Sheaves 1820

"These facts shew the advantage of dunging in this manner. It is plain that the best dung is that of sheep, and that it is more profitable when laid under furrow, than when it is spread upon the surface of the ground by folding.

"In proportion to the product of the bed 842 feet long, which was dunged with two loads of sheep's dung, and produced 17 sheaves; the

the bed 1165 feet long, which was dunged with three loads of horse dung, and produced only 19 sheaves, would, if dunged with sheep's dung, have produced $23 + \frac{1}{3}$; and the bed dunged with cow dung, which yielded but 16 sheaves, would have yielded $17 + \frac{1}{3}$.

"The eight folded beds, whose whole length was 9412 feet, would have yielded 190 sheaves $+ \frac{1}{3}$, instead of only 142 sheaves, which was the amount of their product.

"It is likewise plain, that if the whole of my 12 acres in the new way had been dung'd with sheep's dung, as the bed 842 feet long was; I should, in the same proportion, have reaped 1700 sheaves, which would be but 120 sheaves less than the whole produce of the twelve acres folded all over, and sowed in the broad-cast way. If so, I say, that those 120 sheaves would not be equivalent to the quantity of grain which I saved by sowing according to the new husbandry. An hundred of our sheaves yield, in general, little more than 378 pounds of wheat. The 120 sheaves which the 12 acres sowed in the broad-cast way produced more than the 12 acres in beds, would therefore yield but 453 pounds. Deduct this from 871 pounds, which I saved in the seed of these last 12 acres sowed in the new way, and I shall still be a gainer: for I sowed only 388 pounds in this ground; whereas 1260 pounds were used to sow the other 12 acres in the common way. This would have been the produce of the first year's crop, supposing that the whole of my 12 acres in beds had been dunged as the bed of 842 feet was. For want of that, I reaped but 1208 sheaves. They have just been threshed, and have yielded only 5040 pounds of grain."

M. Duhamel makes the following remarks on this account of M. Roussel:

The 1208 sheaves yielded but 5040 pounds of grain, from which we are to deduct 388 pounds for the seed. The neat produce is therefore 4652 pounds, which would make in three years 13956 pounds. The other field in the common way produced 8757 pounds, from which we are to deduct 1260 pounds for the seed: the neat produce is consequently 7497 pounds; the half of which is 3748 pounds and a half, for the next year's crop. This is all that the 12 acres in the common way would produce in three years, and amounts to no more than 11245 pounds and a half: consequently the balance in favour of the new husbandry, in three years, is 2710 pounds and a half, or one fourth

part of the whole; and that from a field which was sowed in rows for the first time, and of which three quarters were not dunged at all: whilst the other, with which it is compared, had been folded all over, and, for the year, produced a very plentiful crop.

M. Duhamel relates several other experiments, which were communicated to him by different persons, during the publication of his work: but as they contain nothing essentially different from those we have already given, and, like them, were made only on small pieces of ground, we think it needless to mention them here. We shall therefore proceed to the judicious and more extensive experiments of M. de Chateau-vieux, after extracting a few passages from the writings of one of our own countrymen, in confirmation of the advantages of the new husbandry.

“Deep plowing, (says Mr. Miller, in his Gardeners Dictionary,) where the staple of the ground is deep enough to admit of it, will be of great service to corn: for the small fibres of the roots, which are the mouths that supply the nourishment, extend themselves very deep into the ground. I have traced many of them upwards of three feet, and believe they spread much farther where the ground is light: therefore it is of great advantage to the crop to have the ground stirred and loosened to a proper depth: for by so doing, the roots will find a supply of pasture for the nourishment and augmentation of the ears, at the time they are forming, when it is most required: for if the ground is plowed shallow, the roots will have extended themselves to that depth by the spring; so that when the nourishment is wanted to supply the stalks, the roots are stinted by the hardness of the soil, which they cannot penetrate. When this is the case, the colour of the blade is frequently seen to change in April, and seldom recovers its verdure again: and when this happens, the stalks are always weakened in proportion to the decay of the blade: for it is well known from long experience, that the leaves or blades of corn are necessary to draw in nourishment from the air and dews, for the increase of the stalk and ear.

“I have observed, adds he, that, in general, the farmers sow more than double the quantity of corn on their lands than is necessary: therefore there is a great waste of grain, which, in scarce years, amounts

amounts to a considerable sum in large farms; and to a whole country, it is an object worthy the attention of the public: but I fear whatever may be said to prevent this, will have but little weight with the practitioners of agriculture, who are so fond of old customs, as rarely to be prevailed upon to alter them, though they are extremely absurd. But if these people could be induced to make the trial with care, they must soon be convinced of their error: for if they will but examine a field of corn sown in the common way, they will find but few roots which have more than two or three stalks, unless by chance, where there may be some few roots which have room to spread, upon which there may be six, eight, or ten stalks, and frequently many more: but in a field of wheat which had not a greater allowance than one bushel of corn to an acre, so that the roots had room to spread, I have observed that the roots produced from six to twelve or fourteen stalks, which were strong, and had long well-nourished ears, and the produce was much greater than in any of those fields in the neighbourhood, which were sown with the common allowance. And if the land is good, and the roots stand at a proper distance from each other, there will be few plants which will not produce as many stalks as I have here mentioned, and the ears will be better nourished.

“The horse-hoeing husbandry which was practised by Mr. Tull, has been almost universally rejected by the farmers in every country; it being so opposite to their accustomed practice, that they cannot be prevailed upon to make a trial of it: and indeed some absurdities in Mr. Tull himself have greatly contributed to give them a disgust to it; one of which, and that perhaps not the least, is, his positively asserting that the same land would nourish the same species of plants, without changing the crops, for ever, and this without manure*; which his own experience afterwards proved to be false. But notwithstanding these and some other particulars which have been advanced by Mr. Tull, it is much to be wished, continues Mr. Miller, that this new husbandry might be universally practised; for some few persons who have made sufficient trial of it, have found their crops answer much better, than in the common or old method of husbandry; and the French, who have learned it from Mr. Tull's book, are engaging in the practice of it with greater ardour than those

* M. Duhamel, throughout his whole work, takes every opportunity to recommend the use of manures in the new husbandry.

those of our own country; and although they had not the proper instruments of agriculture for the performance, and met with as strong opposition from the persons employed to execute the business, as in England; yet the gentlemen soon determined to persist in the practice of it, tho' yet few of their experiments have had the success they hoped for; partly from the awkwardness of their labourers, and partly from their averfeness to practise this husbandry; and also from their being made in lands not well conditioned; but yet their produce has been equal to that of the old husbandry; and they say, that if the produce of land in the new method of husbandry, does not exceed that in the old way, yet, by saving seven parts in eight of the seed-corn, it is a great affair to a whole country, especially in times of scarcity.

"I shall only mention two or three late experiments which have been made in the new way, whereby the utility of it will more fully appear.

"The first was in a field of wheat, which was sown partly in broad-cast in the common method, and partly according to Mr. Tull's method. The spots thus sown, were not regular in lands, but interspersed indifferently in many directions. Those parts of the field in Tull's method were in rows at two feet distance, and stood thin in the rows. The roots of the wheat in those spots had from ten to thirty stalks upon a root, and continued upright till it was reaped; whereas few of the roots in the common method had more than two or three stalks, and these were most of them lodged before harvest: so that upon trial of the grain when threshed, there was near a third part more in weight and measure, than from the same extent of ground, taken in the best part of the field sown in the common way.

"Another trial was made by sowing of the corn in rows at different distances, with some sown in two parts of the ground broad-cast. The event was, that all which was sown broad-cast in the usual way, was lodged, as was also most of that where the rows were six or nine inches asunder: that which stood a foot distance escaped better, but the rows two feet asunder were the best, and the produce much greater than any of the other; which plainly shews the absurdity of the practice of sowing a great quantity of seeds, to
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* Mr. Miller could not have said this, if he had ever seen the three last volumes of M. Duhamel's work, and particularly the experiments of M. de Chateaux-vieux.

have a better produce, which is the opinion of most of the old farmers. In this case, the farmer had much better let his land lie waste, since the produce will not defray the expense, so that more than the rent of the land is lost. And although these sorts of crops are frequently seen on such land, yet such is the passion for plowing among the husbandmen at present, that if they were not restrained by their landlords, they would introduce the plough into every field, notwithstanding they are sure to lose by it.

But although the produce of these poor downs is so small, as before related, yet upon good land, where the corn has stood thin upon the ground, I have known eight or ten quarters reaped from an acre, over the whole field, and sometimes more: and I have been informed by persons of great credit, that on good land, which was drilled and managed with the horse-hoe, they have had twelve quarters from an acre of land, which is a great produce: and this with greater certainty, if the seasons prove bad, than can be expected by the common husbandry.

Thus far Mr. Miller, whose remarks, we hope, will have their proper weight.

Another trial was made by sowing of the corn in rows at different distances, with some of the ground broad-cast. The event was, that the corn sown broad-cast in the usual way, was lodged, as was also that where the rows were six or nine inches asunder: that which stood a foot distant showed better, but the rows two feet asunder were the best, and the produce much greater than any of the others, which plainly shows the superiority of the practice of sowing a great quantity of seed, so

CHAPTER.

Mr. Miller could not have said this, if he had ever known the value of Mr. Dugdale's work, and particularly the experiments of Mr. Dugdale.

CHAP. II.

Experiments made by M. LULLIN DE CHATEAU-VIEUX, First Syndic of the City and Republic of Geneva, as communicated by him to M. Duhamel.

SECT. I.

Experiments made by M. LULLIN DE CHATEAU-VIEUX, in the Year 1751.

"IN October 1750, says M. de Chateau-vieux, I began my experiments on a spot of ground of a rich strong soil, 165 feet long, and 42 feet wide. Not being yet provided with proper instruments for the horse-hoeing husbandry, I caused it to be dug with a spade, and formed it into seven beds of equal size. Great care was taken to break the clods thoroughly, and to dig the earth very deep. The beds, which were in a loose state, were raised high in the middle.

"On the fourteenth of October, I sowed three of the beds with wheat, two with barley, and two with oats. I must observe that, in this country, it would have been better to have sowed a fortnight sooner.

"I made three furrows in each bed, so shallow, that the seed was not buried above half an inch deep. The wheat was dropt by hand, in single grains, at the distance of six inches from one another. The barley was dropt at nine inches distance, because it branches more than wheat. Though oats branch more than either, yet, as it is a tender plant, and apt to be killed by the winter's cold, I sowed it at the distance of three inches one grain from another.

"I used 2880 grains of wheat, weighing three ounces fifteen pennyweights, to sow the three beds. In one of the beds of barley, I sowed four rows. I employed 1491 grains, weighing two ounces, in sowing the two beds; and four ounces of oats were sufficient to sow the two other beds. I neglected to count the grains.

"These seeds came up very well, and though they grew but little before winter, yet some of them shot out their second leaf. They soon sustained a considerable loss. Numbers of small snails eat many of the plants close to the earth. I judged it necessary to supply this loss, by sowing fresh seed.

"The winter was very unfavourable to corn. We had almost continual

tinual rains, with little snow or frost. The corn in general suffered greatly, and the crops were very inconsiderable in this country.

"Early in the spring, these plants made strong shoots, and had much the better of the corn in the common way. Their blades were very large, and of a deep green, and the number of stalks increased greatly. The alleys were hoed in good time, and the advantage resulting from this operation, was very manifest. I visited my plants towards the latter end of April, and found their numbers greatly diminished. The mischief which the snails had done them, was almost the only cause. The inclemency of the winter likewise destroyed some: so that I found I had lost 1068 plants of wheat, and had but 1812 remaining. My plants of barley fell short by 412, their number being reduced to 1079. The winter destroyed so many plants of the oats, that very few were left.

"From this time, all the plants grew exceedingly: they branched so much, that, as far as I could judge, every plant of wheat, taking them one with another, produced 28 stalks, the barley above 40, and the oats still more. Each plant formed a large tuft, some of 60, 80, and above a third part of the plants of about 150 stalks: so that, though they were at first at a great distance from one another, in June and July they entirely covered the surface of the alleys. All these spindled, and produced, each in its kind, very long and large ears, full of grain from one end to the other. They ripened kindly, but had not yet got over all their mischances. These fine ears were a prey to birds, which could not be kept off. This is an inconvenience to which all small experiments are liable. That I might save something, I was obliged to cut my corn down before it was quite ripe. But before I did that, I examined myself as carefully as I possibly could what the loss might amount to which I had sustained by the birds: and besides this, I sent for four farmers, (in quality of appraisers,) to estimate the damage. They all agreed that it was above half the crop, and assured me I should not mistake if I reckoned it as such. I had formed the same judgment myself. We found the loss somewhat less considerable in the barley. As to the oats, it could not be so well ascertained: but we believed it could not be less than a third part of the crop.

"While the wheat ripened, I discovered that some plants were blighted. All these, whether blighted totally or only in part, I caused to be plucked up, before I cut down the rest of the crop. They amounted to 297; so that I was reduced to 1515 plants of wheat,
the

the seed of which, after deducting that which produced the 297 blighted plants, is reduced to two ounces and six pennyweights. The 1515 plants were the whole produce of the crop, which yielded 55 pounds of 18 ounces to the pound. But the same ground and plants produced likewise what was eaten by the birds; for which it is but just to make an allowance. The whole produce will then have been in reality 110 pounds, which to me seemed very considerable.

"I made another enquiry, which seemed to me of some importance: this was, to know whether the number of the finest and largest ears, was greater than that of the middling and smallest. I examined them with the utmost attention, and found almost all the ears of equal beauty: at least 19 out of 20, I am confident, were so.

"I was likewise willing to know what number of grains might be contained in each ear. To this end, without regarding the proportion I had found between the number of the finest ears and that of the smallest, I took twelve middle sized ears, twelve of the smallest, and twelve of the finest.

"The 12 middling ears contained one with another 37 grains.

"The 12 smallest ears, 30 grains; and

"The 12 finest ears, 50 grains apiece.

"The 1079 plants of barley, produced 75 pounds of 18 ounces to the pound. What was eaten by the birds, should likewise be added here.

"My oats produced 103 pounds of 18 ounces, exclusive of what was destroyed by the birds.

"This little experiment shews, that the new husbandry will be equally profitable for all sorts of grains."

Observations on the foregoing Experiment, by M. DE CHATEAU-VIEUX.

"THE quantity of wheat gathered from the three beds, seems to me as great as could be expected. Though I had but 55 pounds, yet, adding thereto the 55 eaten by the birds, this little spot yielded 110 pounds. In large fields we are not so sensible of what the birds destroy.

"If we likewise take into this account, the 1068 plants destroyed by the snails, and the 297 blighted plants, making together 1365; they would have yielded 100 pounds of wheat, and the whole crop would have been 210 pounds: for it cannot be doubted but they would have yielded in the same proportion as the 1515. What proves

proves it is, that in a space about thirty feet long, at the end of the beds, which escaped the snails, very few plants failed; and the rest were very thriving and branched greatly: so that it is evident, the whole ground could easily have nourished all the plants that were intended to grow on it, and which were at the distance of six inches from one another. I make this remark, in order to shew what may be expected from the following experiments, it being an easy matter to sow the ground so as to have the desired number of plants.

"I suppose then, and I think justly, that this small spot of ground can produce 210 pounds of wheat at one crop: but the inestimable advantage of the new husbandry is, that it keeps the earth in a state fit for sowing every year; so that in two years it can yield 420 pounds; whereas in the common husbandry of this country,* the farmer can have but one crop in that time, being obliged to sow his land only every second year; and that one crop will fall greatly short of the two which the new husbandry will produce. A vast advantage in favour of this last.

"Without being too partial to the new husbandry, we may expect that the second and following crops will be more plentiful, the earth being in finer tilth. Accordingly, the wheat with which I have sowed these three beds a second time, is already visibly benefited by the looser state of the earth which has been so frequently stirred in the summer. I have provided against the accidents which destroyed so many of my plants, by sowing thicker. Instead of three ounces fifteen pennyweights of wheat, which I sowed last year, I have now sowed nine ounces twelve pennyweights: and though the snails have again eat many of the plants this year, close to the ground, a sufficient number still remains, by means of the additional seed, to fill the beds, and they are equally distributed.

"I shall now compare the crop I have been speaking of, with that of the experiment which I made on the same spot of ground in the year 1729, in order to see whether I could not obtain a more plentiful return, by sowing thinner than is usually practised. The ground was plowed and sowed in the common way. I employed six pounds of wheat to sow it, being somewhat less than half the usual quantity. It looked extremely well all the time it grew, and produced above double the quantity that wheat did in the common fields. It yielded me 105 pounds of wheat. Even in this way, I

* The neighbourhood of Geneva.

could have but one crop in two years: and it appears that I have not exaggerated the produce of the new husbandry, in making it 420 pounds in the same space of time, which is a clear gain of 315 pounds.

I have since tried some other experiments; one of which, made in the year 1746, I must now mention. I tried two things at the same time: first, whether wheat would grow after it had been kept several years; and secondly, whether sowing each grain at six inches distance would turn to account. As I did not intend to make the experiment on a large field, I chose for it a spot of strong earth, in bad condition, fit for making bricks. I sowed in it three quarters of an ounce of wheat, which I had preserved carefully for eight years. It rose pretty well*; but about one fourth of the grains did not sprout at all. After the winter, these plants grew very strong. I delayed seeing them too long, for I found them quite choaked with weeds. I sent a woman to weed them, who unluckily at the same time pulled up almost all the plants of wheat: the finest suffered most, she not imagining that they could be wheat. There were but about forty plants left, and those at very great and unequal distances. These produced tufts of upwards of fifty stalks, with ears five or six inches long, containing a great deal of grain, which became the prey of birds. This experiment, if it answered no other end, is at least a proof of the goodness of the new husbandry.

The good success of these little experiments, was a strong inducement to me to make more considerable ones; but in order to this, it is necessary to be provided with a proper hoe and drill-plough: for I must confess that Mr. Tull's did not appear to me to be such. Its great fault is, that it is too complex.

Being provided with a proper hoe-plough, I soon became sensible of the advantages of it. Numbers of such plows are already used in this country; and, which is saying a great deal, even our farmers make use of them.

"This is the plough I used all this summer in preparing my grounds. It did admirably well in the alleys of my experiment, after the corn was above four feet high. No plant was hurt by it, and I could bring the plough as near them as I pleased. Thus it fully and conveniently performs this hoeing, in which I have seldom

*M. Du Hamel observes, that it is very singular that wheat, eight years old, should sprout so well; for that he sowed some of seven years old, which did not rise at all.

used more than one horse. I have likewise prepared with it the ground sowed with wheat this autumn.

"My new hoe and drill-ploughs have made it easy for me to enlarge my experiments this year. However, I thought it most advisable to proceed by degrees; and have therefore limited myself to the culture of about ten acres, according to the new husbandry, part of which is in a very strong soil, part in a very light soil, and part in a middling and stony soil.

"What I have had chiefly in view in my experiments this year is to know exactly what quantity of seed will produce the most plentiful crop. To this end, I have sowed wheat in different degrees of thickness, dropping the grains some at one inch, some at two, and so on, to the distance of six inches from each other.

"All this wheat has at present a fine appearance, and the plants are infinitely stronger than those in the common fields: their blades are much larger, and of a very deep green colour. What is more, they have already branched, and promise a great number of stalks. I have counted on some plants 20, and on others 25. Upon the whole, there is great reason to expect an abundant crop.

"I have made another experiment with the drill-plough, with which I have sowed some of my common fields. Instead of sowing the seed by hand in the broad cast way, as in the old husbandry, I have sowed the whole field with this instrument, without leaving any alleys. This has made a great saving of seed, having employed only twelve pounds of eighteen ounces, to sow the same extent of ground, which used to be sowed with 110 pounds. Yet I think this sufficiently thick: the plants are very fine, and of a deep green. They have already begun to branch, and promise many stalks. Hitherto my wheat gives me reason to be pleased with the experiment I am making. I have sowed about 30 acres in this manner."

S E C T. II.

Experiments made by M. LULLIN DE CHATEAU-VIEUX, in the year 1752.

"MY experiments this year are of three kinds. The first was made on the same spot as last year's experiment: the second on a piece of ground which was made into beds for the first time; and the third, on a field plowed in broad-lands in the

the common way, but sowed with the drill plough, in equally distant rows, without any intermediate alleys.

First EXPERIMENT. No. I.

I Have already mentioned, (p. 139.) that this spot was sowed with wheat, the beds being now made in the middle of the former alleys. The summer hoeings had brought this ground to so fine and loose a state, that, after one plowing, I sowed the three beds with the drill-plough, on the twenty-fifth of September; and to prevent the accidents I before met with, I increased the quantity of seed to nine ounces fifteen pennyweights.

The wheat rose extremely well, and the rows were full of plants, which became very strong and thriving before the winter. The snails destroyed a great number of the plants, as they had done the year before: yet, I judged the rows sufficiently stored with plants, and thought that this accident would do no great damage to the crop.

The winter was very favourable to corn in general. My plants made very strong shoots in the spring: but I found some chasms in the rows, which I had not perceived in the autumn. I imputed it in some measure to the inclemency of the winter, which had undoubtedly destroyed several weak plants. These chasms were but few, and the worst of them had about two plants in fifteen inches.

I horse-hoed the alleys for the first time on the ninth of March, and a second time the twenty-fifth of May. The ground was in so loose a state, that I thought it needless to hoe it afterwards, especially as the wheat was in an exceeding good way. It continued of a very deep green till it ripened; the blades were extremely large; and the plants branched much more than they had done the year before. It was a common thing to find plants with between 60 and 70 stalks, which, in general, grew to above five feet and some inches high, and were crowned with large ears quite full of grain.

As soon as the wheat had done blossoming, I found it necessary to defend it against the birds. Thanks to the care that was now taken, they did it less hurt this year than the last: but still they eat a great deal of it, though I cannot precisely determine the quantity.

As soon as the wheat appeared to be near ripe, in order to preserve it from the farther plunder of those robbers, I reaped it, on the twentieth of July, though I would rather have chosen to let it

stand five or six days longer. It remained in the field four days, to dry, and was thrashed towards the latter end of August. It yielded an hundred and forty two pounds of wheat, at eighteen ounces to the pound.

"This wheat was very fine, perfectly clean, and the grain much larger than in common.

"This experiment gives just rise to the following remarks.

"First; the earth of these three beds having been pulverised and brought to a very loose state by the horse-hoeing in 1751, the plants were stronger and more thriving than those of the year before; a circumstance which contributed to the increase of the crop.

"Secondly; this crop justifies my estimate, that this spot of ground could yield 210 pounds of wheat in one season, if cultivated according to the principles of the new husbandry: for if we add to the 142 pounds reaped this year, the loss occasioned by the birds and snails, it is pretty evident that the whole produce would have nearly amounted to 210 pounds.

"Luckily, that I might be more thoroughly satisfied what loss I suffered by the birds, I counted in two different places how many stalks the plants in the three rows had yielded. On a length of ten feet, I found 1600 in one place, and 2030 in another. As I would always avoid over-straining my calculations, I shall only suppose that every ten feet in length produces 1600 stalks: the beds, being 160 feet long, will consequently contain at least 25600 stalks, and the three beds together 76800 stalks, or ears.

"To know in the next place how many pounds of wheat might be contained in that number of ears, I had as many of them thrashed a month after harvest, as yielded a pound of eighteen ounces. They were taken at random, without culling them, out of a sheaf which seemed to have been but little damaged by the birds.

"Three hundred and sixty ears yielded those eighteen ounces of wheat: so that, dividing 76800, the whole number of ears, by 360, the produce of the crop would be 213 pounds 6 ounces, at eighteen ounces to the pound, or 240 pounds of sixteen ounces. Hence it appears, that my first estimate was pretty just, and that the produce may be even more considerable hereafter.

"Thirdly; this spot was clear of weeds; though it used to be overrun with them. It appears by this, that the new husbandry destroys them effectually; though this advantage will be less felt the first year than in other subsequent years.

"From

"From the observation which I made, that the plants were in a more thriving state this year, than in 1751; it follows, that the earth, far from having been exhausted by the nourishment it had yielded the plants during that year, became more fruitful in this: which can be imputed only to the new culture; the land having received no other assistance, either by dung or manure.

"The wheat was this year, upon a very exact search, free from smut or blight. I found but one blighted ear, though there were numbers in fields contiguous to mine. I cannot however impute this favourable circumstance to the new culture alone: it may have contributed thereto, and may lessen the quantity: but to be sure of that, requires some years experience."

EXPERIMENT. No. II.

"THIS experiment was made on a large field, in which three rows of wheat were sown in each bed, the distance from the middle of one bed to the middle of the next, being six feet *. The whole extent of the field was 1650 square toises, each square toise containing 36 feet.

"The small quantity of seed which I employed in sowing it, certainly required that every grain should grow: but the intended number of plants fell greatly short, several of the grains not rising at all, and many of those which did rise, being destroyed by insects. The greatest damage was done by snails. There were great chasms in the rows, without any plants. As far as I could judge, between a third and a fourth part of the rows produced nothing; and yet the crop was pretty plentiful, as we shall see.

"The hoeings were performed this year at proper seasons, and rather the more frequently to make up for the neglect of the former year: for the ground was not in sufficiently fine tilth when the wheat was sowed.

"On the fourteenth and fifteenth of October 1751, the alleys were plowed for the first time before winter.

"On the ninth and tenth of March 1752, they were plowed again for the first time after winter.

"From the eighteenth to the twenty-fourth of April, the ground was weeded.

"On the twenty-ninth of April, the alleys were stirred with the cul-

U 2

* M. Du Hamel thinks, that by means of the new horse-hoe, the alleys may be made somewhat narrower.

cultivator; which was again repeated on the twenty-fifth of May and the seventh of June.

"This wheat made a fine appearance: the length of the stalks, and the largeness of the ears, shew'd how much the new culture promoted the growth of these plants, which branched nearly as much as those of No. I. This field was reaped on the twenty-fifth of July.

"I shall join to the account of what this crop produced, an estimate of what might have been expected if the same ground had been cultivated in the common way."

A comparison of the produce of the same field, cultivated according to the old, and according to the new husbandry.

"THIS field, which is of a very good and strong soil, was very badly plowed last year, by reason of the frequent and heavy rains, and had not been dunged for several years. In the common way, it used to be sowed with 318 pounds of wheat. This year it was made into beds of six feet wide, and sowed on the twenty-fifth of September with 10 pounds of wheat.

Produce of this field under the new culture in 1752.
 "This field, laid out in beds, produced of very fine large grain'd wheat, } 926 lb.

To be deducted.

"Tho' this wheat was very clean, yet four parts in an hundred were sifted from it, as small corn; } 37 lb.
 valued at } 47 lb.
 "For the seed sown } 10 lb.

Net produce } 879 lb.

"In this husbandry, the same field is sowed every year; so that, supposing the crop of 1753 to be only equal to this of 1752, (and there is no doubt but it will be greater) it will again produce } 879 lb.

Amount of the two crops. } 1758 lb.

Produce

Produce of the old culture.
 "If we judge of it by the best crops of former years, it

will be three times the quantity of the seed, viz. } 954 lb.

To be deducted.
 "Loss by sifting, 15 per cent. It has often been

25 and 30 per cent. and even more. Every time

this field was sowed, the corn was lodged, which } 143 lb.
 prevented the ears from filling, and rendered the } 461 lb.
 grains small and shrivelled.

"For the seed } 318 lb.

Neat produce } 493 lb.

"Consequently the balance, in favour of the new husbandry, is } 386 lb.

dry, is } 879 lb.

"As this field yields but one crop in two years, in the common husbandry, it would produce in that space, } 493 lb.
 only

"From whence it follows, that the neat profit of the new culture in the same space of time, exceeds the other } 1265 lb.
 by

1758 lb.

"Supposing this field never to produce a greater crop than that of this year, it is evident that it is best to follow the new method. But we can already promise, that the succeeding crops will be more plentiful. The field is now sowed in the new way: it has not yet suffered any damage by insects; the rows are well stored with plants, whose more thriving state promises a better crop than last year's.

"It may perhaps be thought odd, that I should limit the produce of the field sowed in the common way, to three times the seed. I know there are lands in this country which yield more, viz. four or five times the seed, and sometimes upwards: but then it must be granted, that there are but few such lands; and that they are fields

in

in extraordinary fine tilth, and enriched with manure. I therefore speak of our lands in general, taking good and bad together. In this case, I say, the produce, one year with another, will not exceed three for one.

"My fields have always been as well cultivated as any in the country. I have computed the amount of my crops for sixteen years running, viz. from 1730 to 1745, inclusively. These accounts were carefully kept by a steward who died a few years ago, and I do not find that the produce ever was greater than what I have been saying, one year with another.

EXPERIMENT, No. III.

"I caused a space of about 1344 square toises of 36 feet, in another field, to be laid out in beds like the former. This land, which is very strong, was but in bad tilth, notwithstanding the care I took to break the earth thoroughly, and reduce it into small particles. The frequent rains were the cause of this. It was sowed with the drill-plough on the twenty-fourth of September. Only seven pounds of wheat were used. The plants rose pretty well: but, towards the end of autumn, they were destroyed daily by insects, and thereby reduced to a very small number, which greatly diminished the crop.

"On the sixteenth of October 1751, the alleys were plowed for the first time before winter.

"On the tenth and eleventh of March 1752, they received their first plowing after winter.

"On the first of May, the ground was weeded.

"On the twenty-third of May, the alleys received their second stirring with the cultivator, and on the twelfth of June they were plowed.

"The plants which came up were very fine, and branched greatly: the ears were like those of the experiments I have already mentioned, and the grain equally large. Tho' the produce was but 392 pounds, yet it is a fine crop for the small number of plants that escaped unhurt.

"As I know the causes to which the scantiness of this crop was owing, I make no doubt but it will equal that of any of the other fields next year. It was now sowed, for the second time, in the new way. The rows are well stored with plants, and the corn is in as good condition as I could wish.

E X.

EXPERIMENT. No. IV.

"THIS experiment was made at the distance of six miles from my house, on a light poor soil, which induced me to dung it.* The beds were about six feet wide, and were sowed on the twenty-first of September with three pounds and three quarters of wheat, which produced fine plants and large ears, and yielded 106 pounds. Tho' the earth had not been well stirred, nor at proper seasons; yet the corn sowed in it produced greatly. The dung undoubtedly helped to make up for the want of due culture."

EXPERIMENTS

Made on fields sown in equally distant rows, with the drill plough.

No. V.

"I Have sowed fields cultivated in every respect in the common way, except in the manner of distributing the seed, which was done with the drill-plough. The whole field was covered with rows of wheat, distant from each other seven inches and an half†.

"The advantages which I proposed to myself, by sowing in this manner, were, first, the saving of seed and preventing the earth from being over-stocked with plants; secondly, burying the seed at a proper depth: thirdly, having the plants at equal distances: and lastly, the little stirring of the ground and breaking of the clods, which the drill-plough effects at the same time that it sows. These things seemed to me more likely to be attended with success, than the common way of sowing.

"The plants of this wheat were very fine: their deep green colour shewed their strength: the largeness of their blades and the number of their stalks, shewed likewise that they found greater plenty of nourishment than wheat in the common way. The plants had, in general, four, six, eight, ten, or more stalks: so that these fields, which, till the month of April, seemed scarcely to have been sown, changed then so as hardly to be known again, by the number of stalks which shot forth at that time. The wheat was taller than that

* M. Du Hamel observes, that tho' dung may generally be spared in the new husbandry; yet it certainly is of considerable use, especially in poor lands.

† M. de Chateau-vieux calls this method of sowing, *semer en plain*; to sow in full. We shall express it by, *sowing in equal distant rows*, in opposition to fields laid out in beds and alleys.

that in the old way, and the ears longer and better filled with grain.

An account of the produce will shew what may be expected from this manner of sowing.

Account of the produce of the same field sowed part in the old way, and part with the drill-plough, on the fourteenth, fifteenth, and sixteenth of September 1751.

THE whole of this field used commonly to be sowed with twenty measures of wheat, each measure containing 106 pounds of 18 ounces. Three measures, or 318 pounds of wheat, were sown in the usual way in the richest part of the field. The remaining part was sowed with the drill-plough, with only 265 pounds of wheat which in the common way would have required 1802 pounds.

The soil was middling, neither too strong nor too light, and pretty stony. The land was poor because it had not been dunged; which indeed it seldom was, the owner not having more than was necessary for his vines.

Produce of the new husbandry.

The 265 pounds of wheat produced 3450 lb.

To be deducted.

For small and bad grain sifted out, 4 per cent. 218 }
For the seed 265 } 483 lb.

Neat produce 4967 lb.

If the other part of the field, which was sowed with the three measures in the old way, had been sown with the drill-plough, it would have yielded 960 lb.

To be deducted.

Loss by sifting, 4 per cent. 38 lb. }
For the seed 46 lb. } 84 lb.

Neat produce to be added to the above 876 lb.

Neat produce of the whole 5843 lb.

Produce

Produce of the old husbandry.

That part of the field which was sowed with the three measures of 106 pounds each, produced thrice the quantity of the seed, mixed with bad grain. The same measure of this grain weighed but 103 pounds. This field yields no more even in the best years. If the whole of it had been sowed in the old way, it would have produced 6180lb.

To be deducted.

Loss by sifting, 15 per cent. It has often } 927lb.
been 25lb. and 30 per cent. } 3047lb.
For the seed } 2120lb.

Net produce 3133lb.

Balance in favour of the new method 2710lb.

5843lb.

EXPERIMENT. No. VI.

"I Sowed, continues M. De Chateau-vieux, another field of about 1020 square toises of 36 feet, in the same manner, with thirty pounds of wheat, reckoning 18 ounces to the pound, on the twenty-fourth of September. The soil was strong, and in fine tilth. The wheat grew in every respect like that of the preceding article, with this only perceptible difference, that the straw was somewhat longer, and the ears larger. It was not threshed till the beginning of December, and yielded 809 pounds of very fine wheat (the pound 18 ounces). The produce of this field was greater than that of the former, in proportion to the quantity of seed. But the soil of this was better, and in finer tilth."

EXPERIMENT. No. VII.

"THIS experiment was made about three miles from me, on a piece of ground of the extent of about 880 square toises. This land is neither too strong, nor too light, and may be called a pretty rich soil. It was plowed three times, like other lands; and had not been dunged for many years. It used to be sowed with 165 or 170 pounds of wheat. It was now sowed on the 5th of October, with only 24 pounds. Tho' the season was so far advanced,

vanced, this seed came up pretty well before winter. The plants thrived greatly in the spring, and the field became covered with strong stalks, and very large ears, full of fine plump grain.

The crop yielded 800 pounds of clean wheat, without mixture of any other seeds. Deducting from this the 24 pounds of seed, the neat produce is 776 pounds. This field, sowed in the common way, produces in the best years, about 875 pounds: from which if we deduct 165 pounds for the seed, the neat produce will be 710 pounds. Thus we see that the same ground sowed with the drill plough, produced 66 pounds more than when sown in the common way. But as wheat raised in this last way is always mixed with abundance of seeds of weeds, which must be separated by sifting, an allowance must likewise be made for that; and the profit will then not be limited to the 66 pounds only, which the owner reaped more than in the common way.

I omit several experiments of wheat sowed in beds, and with the drill-plough, in equally distant rows, the success of which has been nearly equal to that of those I have already spoken of. I shall mention only one more, and that, on account of a circumstance which deserves to be known. I made it on a light soil, the worst I knew of, full of pretty large stones, and which had not been changed in the memory of man. The stones did not hinder the drill-plough from dropping the seeds very regularly. I chose this bad soil, on purpose to see how wheat would thrive in it. I allowed too little seed, considering the badness of the soil. The stones prevented many plants from rising, and many more were destroyed by insects; so that the corn was very thin, and the crop small. I was, however, pleased with it, because I found the plants grew almost as strong as in a good soil, and the ears were as large, and as full of grain.

"A little before harvest, the wheat of all these experiments sustained many heavy rains, accompanied with very high winds; and though the straw was much longer than that of the wheat which had been sowed in the common way, the corn was not lodged; whilst a great deal was in the neighbouring fields. Some indeed was bent; but that is different from being lodged. This last is very hurtful to the filling of the grain, but its being bent is attended with no inconvenience. I am even inclined to think that

We were therefore right, says M. Dubamel, in observing, that corn would be less liable to be lodged in following our method, than in proceeding in the common way.

that it may be of service to the wheat, not to remain in a perpendicular direction; and intend next year to be particularly attentive to this.

"It is not at all to be wondered at, that plants sown in the common way, should not thrive so well as those which grow in beds. The former, not having been assisted by the stirring of the mould, cannot draw so much nourishment from the earth, as those in beds. The size of these last has indeed exceeded my expectation. There is reason to be satisfied with this manner of sowing, even if it were attended with no greater advantage than this year's crops afforded. But if the quantity of seed is increased, so that the field be stocked with as many plants as it can nourish, the profit will be so much the more considerable.

"It is time to return to our experiments on fields laid out in beds, which are the more immediate object of the new husbandry.

"Those which I have made this year, have not brought the produce of the new culture to near what it will be hereafter; as will appear from what I shall next observe."

Reflections of M. de Chateau-vieu, which prove the truth of the principles on which the new husbandry is founded.

"WE see by the experiment, No. I. that the earth, being in a looser or more divided state the second year, is better able to afford a greater quantity of nourishment to plants, whose productions will always be proportioned to the ease with which they can reach that nourishment.

"I was in hopes that the experiments of this year would have enabled me to determine what quantity of seed it is best to sow, in order to obtain the greatest crop. The lands on which I sowed the most seed last year, shewed me plainly, that it would be right to increase the quantity, in order to provide against the accidents by which the plants had been thinned too much.

"But this increase of seed should be regulated with great discretion, regard being had both to the circumstances of the season in which the seed is sowed, and to the condition of the ground in which it is planted. If the soil is in very fine tilth, less seed will be sufficient.

"The experiments of this year shew, that there are but three principal means by which we can obtain the utmost production that plants are capable of affording. These means are practicable

only in the new husbandry: for in that alone each bed has the number of plants it can properly nourish; which is the source of plenty.

"The first means is, to make the plants produce a great number of stalks.

"The second is, to make each stalk bear a large ear.

"The third is, to make each ear be quite full of plump grain.

"These effects cannot be obtained in the old husbandry, because they can only be procured by frequently stirring the earth.

"All my experiments this year, shew the truth of this: but especially the experiments No. I. and II.

"It is therefore by stirring the alleys while the plants are yet young and growing, that we can make them produce a number of stalks, cause those stalks to bear large ears, and fill each ear with large plump grain. But to obtain these advantages, it is of great consequence that the hoeings be performed at proper seasons; each having its peculiar effects.

"The plowing before winter, is intended to drain off the water, which if it should remain long near the plants, would chill and greatly hurt them, and to lay up the earth to be mouldered by the winter's frost. It is hereby enabled the better to supply the plants with their necessary food in the spring. This may be done at the farmer's conveniency, from the time that the plants have three or four blades, till the frost sets in: and even in the winter, if it does not freeze, plowing will always be of service.

"The first plowing after winter, is of great importance. 'Tis to this that we owe the number of stalks which the plants produce. That it may have this effect, it must be performed as soon as the severe colds are past; and, at latest, as soon as the plants begin to shoot. If it be delayed longer, it will contribute very little towards their branching. It will serve only to make the stalks grow longer. If any new ones shoot out, they will not thrive so well as the first; and therefore it is of great consequence that they shoot out all together.

"The hoeings that are performed from this time, till the wheat has done blossoming, strengthen the plants, lengthen the stalks, and enlarge the ears. The season of these hoeings is not so exactly limited as that of the former, and the frequency of them will depend greatly on the state of the ground: for it must not be touched when it is too moist. If the season is kindly, they may
be

be repeated two, three, or four times: but I think one hoeing highly necessary just before the ears break forth. They certainly grow longer and larger by it.

The last hoeing is the most important of all, and that which can least be dispensed with. It must be performed as soon as the blossom is gone off the wheat. *This fills the whole ear, and swells the grain.*

When farmers become sensible of the good effects of these frequent stirrings, they will not neglect to repeat them at the proper seasons. It is by a succession of them, that, in my opinion, crops can be brought to their highest perfection: and if unfavourable seasons prevent their being done at their proper times, a diminution of the crop will most assuredly follow.

No one who considers the produce of the ears of corn on lands cultivated according to the new, and the old husbandry, will, I believe, doubt which of these is to be preferred. I shall bestow a few moments, to point out the difference which I have found between the one and the other.

I said before, that 360 ears yielded me 18 ounces of wheat. Here is a determined fact; and I am certain that I have not enlarged it; because the birds had eat some of the grain: otherwise fewer ears would have produced those 18 ounces.

When, in the year 1750, I first began to inquire into the principles of the new husbandry, I judged it might be of some importance to come at the knowledge of what the usual produce of a plant of wheat is, when cultivated in the common way. That year was reckoned a very good one for wheat, which appeared clean and good as it stood upon the ground. I took this method to come at the knowledge I wanted:

I took part of a sheaf which appeared to me very good, and which was the produce of a very rich field. I divided it into three parcels. In the first parcel were all the good ears; the middling and small ears were in the second, and the ears in which there was no grain, or where the grain was faulty, composed the third.

The wheat being thus divided, I counted the number of ears in each parcel. I found 400 in the first, which consisted of the best ears; 1600 in the second, which contained the middling and smallest ears, and in the third, 750 ears, or plants whose grain was faulty. I made no account of a great number of imperfect shoots which were not six inches long.

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"The fields did not look so poor to the eye, as this separation proved them to be. This first operation was therefore necessary to come at the truth:

"On clearing the grain from the ears, I found that the 400 ears contained five ounces and a half of wheat, and that the 1600 contained seven ounces.

"My curiosity did not lead me to inquire into the contents of the third parcel; knowing that there was no good grain in it.

"In the pursuit of this inquiry, I found that taking one ear with another, of the 400, there were but eleven grains of wheat in each; and that in the 1600, taking one ear with another, there were but three grains and an half to an ear. Eight hundred of these grains weighed but an ounce.

"If we add these parcels together, we shall find that 2000 ears yielded but 12 ounces and an half of wheat, and that it would require 2800 ears of the same goodness to yield 18 ounces.

"I confess I was astonished at the result of my inquiry, which I could not have believed, had I not seen it. But at the same time, how greatly was my expectation raised of the advantages of the new culture!

"I have this year formed a greater extent of ground into beds. The too frequent rains have prevented my laying down more than 30 acres in this manner; but I have sowed all the rest of my farm with the drill-plough in equally distant rows. I have increased the quantity of seed; regard being had to each circumstance necessary to be attended to; so that in some fields I have sowed double the quantity of seed that was employed in the year 1751; in others somewhat more, and in others again less.

"All my fields look extremely well, and make a much better appearance than they did last year. They are abundantly stocked with very strong plants, of a deep green colour: the blades are long and large, and cover the earth better than the common wheat.

"Hitherto, these plants have sustained no loss, except in one spot of about half an acre, where they were gnawed asunder, just under the surface of the earth, by insects. I immediately sowed it again, and by this means have quite made up the loss. The insects have not appeared since.

"One of the most happy effects of my experiments, is, that they have created a desire in many persons in these parts, to begin the practice of the new husbandry, by trials of considerable extent.

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One person, convinced of its excellency, has laid out and sowed at least twenty-eight acres in beds: another has sowed with the drill-plough, an hundred and fifty acres plowed in broad lands. All the land that has been sowed in beds amounts to about fifty acres, and upwards of two hundred acres in broad lands have been sown with the drill-plough. Every one who has seen these grounds, even the very plowmen not excepted, agree that they look extremely well, and that they never saw in this country plants of such strength and vigour, as the wheat that was first sown.

I am extremely happy that my drill-plough has been of so general use. It has every where done its business very regularly, people having sowed with it the exact quantity of grain they have desired.

SECT. III.

*Experiments made by M. LULLIN DE CHATEAU-VIEUX,
in the year 1753.*

"I AM the better pleased that I am able to give a satisfactory account of the success of my experiments this year, as the seasons have not been favourable, and extraordinary accidents have greatly diminished the produce of the crops.

"I shall divide this account into several articles:

"The first will contain the experiments made on lands laid out in beds, which have borne their second and third crop. To this will be added some observations relative thereto.

"The subject of the second will be a detail of experiments made on lands formed into beds, which have yielded only their first crop. This too will be followed by some remarks.

"The third will consist of the experiments of two persons, on lands made into beds, of which the first crop was reaped this year: to which will be subjoined some necessary reflections.

"The fourth article will contain an account of several experiments made by divers lovers of Agriculture, on lands sown in equally distant rows, but with the drill-plough.

"As we think it will be extremely useful to shew, by the experiments which have been made this year, that lands produce more corn by the new husbandry, than by the old; we shall give an account, in the fifth article, of the crops of fields sown in the common way for sixteen years together; and of those of the same fields cultivated according to the new husbandry, supposing them

not to yield better crops in future years, than they have done in this; a supposition the least favourable that can be to the new culture, since we calculate only upon the produce of the first year's crop, and that too diminished by the extraordinary accidents which we shall mention.

"To shew the truth of this article more fully, it will be proved in the sixth, that the best field in the country, though it had been well dunged, yielded less wheat than those on which the experiments were made, and on which no dung was used.

"The seventh article will consist of reflections and observations on our practice of the new husbandry; and the eighth will shew the disposition of our lands for the crop in 1754.

"To avoid repetitions, we shall observe here, once for all, that no dung or other manure was used in any of our fields; that the extent of all our fields is computed by square toises, of thirty-six square feet to the toise, and that our pound consists of sixteen ounces."

ARTICLE I.
Experiments made on lands laid out in beds, which had born a second and third crop, with some observations particularly relating thereto.

EXPERIMENT. No. I.
N. B. *This experiment is marked with the same number in the year 1752. (p. 145.)*

"I Should have known the full produce of this third successive crop on the beds of this field, continues M. de Chateau-vieux, if the hail which fell on the third of June had not damaged it greatly: The abundance of rain which fell at the same time, and immediately after the hail, did still greater hurt; for the earth of part of the beds was washed away by the torrents of water, some of the plants were forced out of their places, others were entirely covered with earth, and many were torn up by the roots; so that it was not possible to judge what this year's produce would have been, by the few plants that were left.

"I am very sorry that this accident deprived me of a certain proof, that this year's crop would have been more plentiful than that of 1752: for it would have been evident, that the earth becomes more and more fruitful by the new husbandry: a truth, which

which it is of consequence to establish. I can therefore only affirm by conjecture, that this crop would have been greater. It is true, my conjectures are so strong, that they amount almost to a demonstration.

"I draw them from hence: that the corn had a very fine appearance before winter; that the plants grew with great strength in the spring; that they branched more than formerly; that the ears were certainly larger; that they blossomed extremely well; (they were in full bloom by the thirtieth of May;) and lastly, that there is more straw than in 1752.

"It necessarily follows from hence, that had it not been for the hail and torrents of water, the crop would have been greater than in 1752.

"Though the following experiment suffered the same accidents, (except that the beds were not broken up by the water,) it will supply the want of that information which we were deprived of in the other, and strengthen our conjectures."

EXPERIMENT, No. II.

N. B. *This experiment is marked with the same number in the year 1752. (p. 147.)*

"AS I hope this experiment will be found very instructive, I shall relate it with the same care that I executed it. I therefore beg it may be particularly attended to; for it will confirm the advantages of the new husbandry. But before I enter into a detail, of which I shall endeavour not to omit any essential circumstance, it is necessary to repeat here, that, in the journal of 1751, I said, 1. That the plowings which had been given the earth in order to its being sown in 1752, had not loosened it sufficiently, and that I tried to remedy this defect by subsequent culture. 2. That this field was sowed on the twenty-fifth of September with eleven pounds and four ounces of wheat. 3. That the crop yielded a thousand and forty two pounds twelve ounces: and lastly, that the appearance of the young plants promised a much greater crop in 1753.

"The culture bestowed upon these lands in 1752, rendered them more and more loose and well divided, so that with only one plowing after harvest, which was performed with the utmost ease, I formed new beds, the ridge of which was now in the place where the furrow in the middle of the alleys was before. But the earth

was deeper stirred and made much looser than in 1752. I had already attained almost a perfect tilth, and easily foresaw that I might quite complete it in 1753.

“ Whilst I laboured assiduously in the culture of wheat, from which I would not suffer any thing to divert my intention too much, till I should arrive at a good and certain practice of the new husbandry; I nevertheless determined to begin experiments on lucerne and sain-foin, to cultivate them nearly in the same manner as wheat. What prompted me to this, was the success of a small experiment the year before. Accordingly, taking this object likewise into serious consideration, I resolved to leave a part of this field for lucerne, and to sow the rest with wheat. It contained in all 1650 square toises, formed into 45 beds. I left for the lucerne, nine beds, the extent of which was 303 square toises; and destined the surplus to be sowed with wheat, as before. I am now very attentive to the experiments on lucerne and sain-foin, and shall begin next year to give an account of them, and of my manner of proceeding. My practice in this, will be found different, in many respects, from the method which is commonly pursued. I will venture to affirm, that there will be room to be satisfied with the success of this branch of husbandry, than which none can be more interesting: plenty of fodder being as necessary as plenty of corn.

“ I must therefore beg leave to give the produce of this field, as if the whole of it had been sowed with wheat. This I do, in order to compare the produce of 1753, with that of 1752; as it cannot be doubted but that the nine beds now under lucerne, would each of them have yielded as much wheat, as any of the beds did that were sown with it: nay, perhaps some pounds more: the lucerne being sown in what I thought the richest part of the field. This field was sowed on the first of September. I increased the quantity of seed, sowing this time thirty four pounds fourteen ounces of wheat; whereas in 1751, I sowed but eleven pounds four ounces. Though I sowed this year more than thrice the weight of seed that I did in 1751, it must not be inferred that I tripled the number of grains capable of producing plants; because this year's sowing was made with wheat of the produce of the new culture, the grains of which are much larger than those of the common wheat which I used in 1751, and of which a greater number is consequently required to make up an equal weight.

“ This wheat having been sown pretty early, its plants had time to grow.

grow very strong before winter, the cold of which they bore very well: and the plowing I gave them on the fifteenth of October, by cutting a very deep furrow within about three inches of the rows, secured them from the damage which corn frequently suffers from rain or the melting of the snow.

"In the spring, they made strong shoots, grew apace, and branched very abundantly. I assisted them, as I am going to relate, at proper seasons, both with respect to the condition of the plants and earth, and to the temperature of the weather.

"On the fifteenth of March 1753, I gave them the first plowing after winter.

"On the twenty-sixth, the beds were weeded.

"On the eleventh of April, I stirred them with the cultivator.

"On the twenty-sixth, the thistles were plucked up.

"On the fourteenth of May, the stirring was repeated with the plough.

"On the fifteenth, the ears began to appear.

"On the twenty-ninth, the fourth stirring was given with the cultivator with mould boards.

"On the thirtieth, the wheat was in full bloom.

"On the third of June the wheat sustained a violent storm of hail and rain.

"On the thirteenth, the fifth stirring was given with the new plough with two shares, or double cultivator.

"I beg leave to observe, that there needs no further proof that wheat, cultivated according to the new husbandry, will be little apt to be lodged, than the ease with which I performed the fifth culture, after the accidents which happened on the third of June, when the wheat had attained its greatest height. So far was it from being laid thereby, that the whole extent of the plough found free admittance into the alleys, and this last culture could be given without damaging the stalks.

"Tho' the whole of our plowing and hoeing may be performed extremely well with my plough and the instrument which I call the *cultivator*, yet I have thought of making this task still more easy. Two new instruments, (not indeed absolutely necessary,) will answer this end. I propose them only as very useful, and proper to be employed only the second or third year, when the earth has acquired part of that minute division, of which it is susceptible.

"The cultivator with mould-boards, and the plough with two

shares, are two instruments which I have invented this year. I have found them extremely useful to give the two last stirrings, better, and in less time than our other instruments. The reader may not be displeased to know what first set me upon contriving them.

"One cannot enter properly into the spirit of the new husbandry, without being thoroughly convinced that the earth cannot be too minutely divided: I will even say, till it is reduced to a perfect powder; and that when one has been so happy as to attain this point, it must be kept in that state. This will always be done best, by using the most proper instruments.

"I observed one day, whilst I was hoeing my wheat, my plough being then at work, and the earth in a very loose state, that every time the alleys were stirred, they were thrown into a different form: for it is necessary sometimes to make a deep furrow in the middle of the alleys, and at other times to raise a ridge in them; and yet, in whatever form the alleys were, I had only my plough to perform these different operations. It did not seem to me reasonable to suppose, that two so different works could be done equally well with one and the same instrument: whence I concluded that it was necessary to have an instrument for each of these purposes.

"I soon found what I wanted. The cultivator with mould-boards opens a large furrow in the middle of the alleys, by turning over the earth at the same time to both sides. The plough with two shares, on the contrary, at the same time takes up the earth on both sides, and turns it into the furrow, which it fills, and thereby lays the foundation of a new bed.

"These instruments have this farther advantage, that, without requiring a greater number of oxen or horses, they perform as much work at once going over the ground, as the plough can do in two, and sometimes three operations. I return to my experiment.

"On the twenty-third of June, the wheat sustained a violent hurricane, which lasted an hour. Several great pear-trees were blown down in my orchards, and many large branches were broke off from other trees.

"On the eighth of July, a scorching wind blew, which shed a great deal of the ripe corn.

"On the ninth, the wheat was reaped.

"A month after harvest, it was threshed.

"This field yielded 1575 pounds of wheat; deducting from which the 34 pounds 14 ounces used for seed, the neat produce

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remaining is 1540 pounds two ounces. Consequently, in 1753, this field produced 533 pounds four ounces more than in 1752, including what was saved in the seed.

"The grain of this wheat was very large, and so clean, that it did not want sifting. It yielded plenty of very fine flour, which made exceeding white and well tasted bread."

EXPERIMENT, No. III.

N. B. *This field is marked with the same number in the year 1752.*
(p. 150.)

"THIS field contains 1344 toises, and was but in poor tilth." It was sowed on the twenty-fourth of September 1751, with seven pounds of wheat, and yielded 441 pounds.

"It was brought into better tilth in 1752, but the beds were not raised high enough: I would have given them another plowing, had not the rainy season prevented me. They were sown on the eighth of September, with 24 pounds 12 ounces of very large grained wheat. The plants were very fine before winter, and the rows were well filled. In spring, I found that there were fewer plants than in autumn: insects had destroyed several of them. I likewise imputed the loss of many to the flatness of the beds. The plants acquired fresh vigour after the winter, made strong shoots, and branched extremely well. I treated this field in the same manner as the former. The plants made nearly the same progress. They were reaped on the fourteenth of July, and yielded 724 pounds 8 ounces. Thus we see that this field yielded 283 pounds 8 ounces more in 1753, than in 1752.

Observations on these experiments.

"I Observed in my former experiments, that as the mould was not sufficiently loosened, the fields which were laid out in beds could not produce so plentiful a crop the first year, as they would the second or third, when the earth should be more thoroughly divided. It is evident, that whoever should have given up the new husbandry, on the bad success of the first year, would have deceived himself. These experiments plainly shew, that the charge of the first year is fully compensated by the profit of the second, and that this profit will increase from year to year.

"Whoever now tries the new husbandry, may reasonably expect bet-

better crops than mine, even the first year, because, 1. They now know the preparations which the earth requires: 2. They may be provided with instruments already experienced to answer their purpose with conveniency and ease. The different circumstances to be attended to, are likewise known. From the knowledge I have acquired in these matters, I can say, that the present appearance of the corn, which I have sowed this year in beds, promises a very great crop next season. I shall likewise have occasion, in the course of these observations, to shew, that though the first crop may seem very small, yet it is in fact more profitable than that of lands cultivated in the common way.

“ Let us now proceed to the present state of the lands cultivated for two years according to the new husbandry, and observe what the effects have already been.

“ When the corn was sowed, the beds were in a much looser state than before, and the grain consequently covered with a fine mould. It came up better, the roots more easily extended themselves, and increased in number, in a soil which scarce resisted them: the plants were stronger, and better able to bear the severity of the winter; and by a small increase of the seed, the earth was better filled with plants, and thereby better able to sustain the accidents which had thinned them before. After the winter's frosts were over, the mould was in so loose a state, that it looked as if had been newly plowed: a very different state from that of land in the common husbandry, which is at this season hard, compact, and very little fitted to afford an easy passage to the tender roots of plants. How easy too did this render all the subsequent culture! The weeds, already greatly diminished, did little damage to the corn; and we may readily conceive that the earth, in this loose state, was easily penetrated by the rains, dews, and moisture of the atmosphere.

“ The effects were, that the plants grew stronger and taller than before; that they branched into a greater number of stalks; that the ears were very large and well filled with grain, if we may judge by those which escaped the hail; that the wheat was very clear: and lastly, that the crop was greater than that of the preceding year, though it had been greatly diminished by the hail, the hurricane, and the scorching wind which made many of the ears shed their corn. I tried every possible means of ascertaining the loss occasioned by these accidents; but in vain. I have therefore given up an uncertain calculation; and all I can say, is, that I am sure the loss was very considerable.”

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ARTICLE II.

Experiment made on lands which had borne a first crop. Remarks on these experiments.

"WE did not expect that the fields we are now going to speak of, would yield a crop near equal to that of the fields we treated of in the foregoing article. We knew that the mould is never sufficiently broken and divided the first year that a field is laid out in beds. Besides, almost all last year, the earth was too moist to be cultivated properly. The wet mould could not be divided into small particles, nor could it be plowed so frequently as to admit of sowing it so early as it should have been.

"But every year will not be so unfavourable to this husbandry; and when there are alternate changes, such as we have had this year, of wet weather and fair, which will afford time for the different plowings, we may, with some certainty, promise ourselves a more abundant crop; since, as we have seen, it depends chiefly on the good or bad state of the earth.

"The whole management of these fields having been nearly the same with that of the second experiment, it would be needless to give a particular detail of it in our account of the other experiments."

EXPERIMENT, No. IV.

"THIS field is a very strong good soil. In the old husbandry, it required great strength to plow it, and it was necessary to catch the seasons when they were neither too wet nor too dry. It contains 16487 square toises. I laid near one half of it out in beds, which, with the alleys, were each about six feet wide. Part of these beds were sown on the thirtieth of August. Constant rains prevented the rest from being sown till the twenty-sixth of September. An hundred and eighty one pounds of wheat were employed in sowing the whole. What was first sowed, came up well, and the plants were very strong before winter: but in one place, almost all of them were destroyed by insects. I sowed this spot a second time. The fresh seed was scarce able to rise before winter, and yielded much less than the beds which had not met with the like accident. The wheat of the beds which were sown the twenty-sixth of September, was a long time before it sprung up, owing to the dryness of the earth, which:

which continued almost the whole month of October. The frost in November stopt the further progress of the plants. Their produce was much short of what was sowed first; which shews plainly how essentially necessary it is to sow early.

"This wheat must of course grow very unequally. Some beds were extremely beautiful, others middling, and the rest very poor: yet, throughout the whole, the ears were very large and well filled with grain: and the crop would still have been a good one, had it not suffered by the hail on the third of June, and the other accidents mentioned in the second experiment.

"The wheat, being perfectly ripe, was reaped on the 13th and 17th of July. It was threshed two months after, and the whole produce of this half of the field was 3370 pounds of very fine and perfectly clean large-grain'd wheat, which yielded a great deal of flour.

"The other half of this field was sowed in equal distant rows with the drill-plough, by which means a great deal was saved in the seed: for only 479 pounds of wheat were employed to sow this ground, which, in the common way, would have required about 2016 pounds.

"It was sowed on the 23d, 24th, 26th, 27th, and 29th of August. We could work only a few hours a day on account of the frequent showers of rain.

"This wheat rose extremely well, and grew very strong before winter, and of a deep green colour, which it retained till it began to ripen. The number of stalks increased in the spring. They grew very long, and bore large ears: in short, they promised a fine harvest. But the hail of the 3d of June soon changed the face of the field. It cut off a great number of the ears, broke down many stalks, and damaged all those ears whose stalks were strong enough to remain upright. This misfortune was common to all my wheat.

"This wheat, being ripe, was reaped on the 9th, 10th, and eleventh of July, in very hot, dry weather. It was threshed a month after harvest, and yielded 5386 pounds of excellent grain.

"Here is an experiment made upon a large extent of ground, cultivated two different ways, and divided into two almost equal portions, both of which suffered the same accidents as equally as could be, according to the best of my judgment. This experiment offers us a very interesting instruction.

"The design of our experiments is, to know which of the different methods of husbandry is most useful; which will best promote the public

public welfare, be most beneficial to the owners of lands, and bid fairest to secure their productions.

"Let us now compare the produce of each half of this field. It will convince us of a truth of great consequence to be known, viz. that land will produce much more corn when cultivated in beds according to the new husbandry, than when it is only sowed in equally distant rows with the drill-plough; though this last method is indisputably better than the old husbandry.

"We have seen that the part of this field, which was sowed in equally distant rows with the drill-plough, produced 5386 pounds of wheat. If it is continued to be cultivated in the same manner, it will be in fallow in 1754, and yield no produce: and thus it will bring a crop only every other year.

"The other part of this field, which we formed into beds, produced 3370 pounds of wheat, and is already sown again for a crop to be reaped in 1754. Supposing this crop to be only equal to that of 1753, the produce of the two years will be 6740 pounds of wheat. Hence it is evident, that, in two years, the produce of the beds will be 1354 pounds greater than that of the rows. This difference is very considerable: and if we would see it in a yet stronger light, let us extend the same calculation to a longer time; for example, to ten years, during which the part sowed in rows will yield only five crops, which at 5386 pounds a crop, will amount in all to 26930lb.

"The part sowed in beds will yield ten crops, which } 33700 lb.
at 3370 pounds a crop, make

"The difference in favour of the beds will therefore } 6770 lb.
be in ten years

"We here suppose the seasons to be, in every respect, like the year 1753. But as our observations have constantly shewn that the crops are always greater after the first year, which is likewise justified by the first, second, and third experiments, we may even now venture to pronounce, that the part of our field, which is sowed in beds, in order to be reaped in the year 1754, and which now makes a promising appearance, will yield double the quantity it did in 1753. The profit will therefore be much more considerable than we have made it in the above calculation.

EXPERIMENT. No. V.

"THIS field is of a very stiff soil. It contains 8112 square toises, and lies sloping towards the West. The beds were well formed, but the earth could not be sufficiently broken, nor could it be sown early enough, on account of the frequent rains. It was sowed on the 8th and 25th of September, with 139 pounds of wheat. The corn came up well, and made a fine appearance before winter. It throve well during the spring, and when ripe, I cut it down, viz. on the 14th and 28th of July, and the crop yielded 2205 pounds of very fine wheat."

EXPERIMENT. No. VI.

"THIS field was reaped in 1752, and immediately formed into beds, with a design to sow it that same year. I could not expect that land in so bad tilth could produce much. All I aimed at in what was done, was to form it into beds a year the sooner. It contained 1928 toises, and was sowed with 45 pounds of wheat, which yielded 724 pounds."

EXPERIMENT. No. VII.

"MY desire to practise the new husbandry upon all my lands, as soon as possible, made me plow another field, which had likewise been reaped in 1752. I could however lay only a part of it out in beds: the rest was sowed in equally distant rows with the drill-plough. This field could have but one plowing: nor could that be completed, tho' several ploughs were employed, till the 15th, 17th, and 18th of November. The earth was so moist, that it divided only into large clods. However, I sowed it soon after plowing, not expecting a great crop*. The extent of this field is about 8213 toises. It was sowed with 412 pounds of wheat, of which only a small part rose before winter. The number of plants increased greatly in the spring: they could not branch so much as those of the foregoing experiment, and the grain beginning to look a little shrivelled, I cut it down on the 21st, 23d, and 24th of July. Though this wheat had suffered the same accidents as the other, yet it yielded 2646 pounds†."

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* If, says M. Duhamel, M. De Chateau-vieux had continued to plow his lands in order to sow them with spring wheat, he would have begun the new husbandry with a crop almost as good as that of winter wheat.

† We see, from this experiment, that a diminution of tillage greatly lessens the crop.

ARTICLE III.

Experiments made on lands laid out in beds, and of which the first crop was reaped in 1753. Reflections on these experiments.

"IN our journal of 1752, (p. 159.) we mentioned a person's having sowed at least twenty-eight acres in beds. Though these experiments did not answer well, we have thought proper to mention them, in order to shew the causes to which their want of success ought to be imputed. They will serve to instruct us in some practices which are more necessary than might otherwise be imagined, and fix our attention to circumstances which ought not to be neglected by any one who desires to make the most of his ground."

EXPERIMENT. No. VIII.

"THESE twenty-eight acres were laid out in beds about six feet wide. The soil is strong, and apt to grow very hard. Three rows were sown in each bed.

"Only 460 pounds of wheat were used to sow this field, which yielded but 3150 pounds of very clean grain.

"This is a very small crop. Let us see to what it was owing.

1. "This land was very badly plowed: it could only be divided into great clods, incapable of supplying the wants of the plants, and of letting them imbibe the nourishment necessary for their growth. That the bad state of the land was the chief cause of the smallness of this crop, appears from this; that the mould in some small parts of the same field being better divided, the wheat, in those places, was finer, branched tolerably well, and produced a greater number of flourishing plants.

2. "This field was sowed too late, viz. not till the last week in November. Only part of the seeds sprung up before winter. These plants not rising in a good season, could not make the progress that might otherwise have been expected.

3. "Too little seed was sowed. It was the more necessary to sow a larger quantity, as in lands badly prepared, numbers of grains cannot shoot at all, and many of those that do shoot, are so buried under the great clods, that they are not able to rise. This field was therefore not sufficiently stocked with plants.

" Lastly, the hail we mentioned before, greatly diminished the crop*; which, independent of that accident, would not have been plentiful.

" The owner of this field, after remarking the bad consequences we have been speaking of, arising from the defect of culture, has endeavoured to remedy them, by giving, after harvest, several plowings, which have broken and divided the earth more thoroughly, and prepared the beds for being sowed in good time: the quantity of seed has likewise been increased; the plants have had time to get strength before winter, and their present state promises that the next crop will be better. Far from being discouraged by the bad success of a first trial, the person we are speaking of, convinced of the excellence of the new husbandry, is but the more resolved to pursue it. He justly ascribes the scantiness of this crop not to any defect in the principles of the new husbandry, but solely to its having been badly executed the first year. He soon perceived that these faults might easily be remedied, the second year; and therefore has not only continued to cultivate and sow the same field, but has likewise sowed at least twenty-five acres more made in beds, which have been much better plowed than those of last year: every circumstance of the new culture has been duly attended to, and the corn, even now, promises a more plentiful return."

EXPERIMENT. No. IX.

" **S**MALL experiments have led to much greater. As those small ones are necessary at first, not only to create a confidence in the new husbandry, but likewise to accustom people to the practices which it requires, I shall relate one of this kind, made by a person who has adopted the new husbandry from principle, and who is every way qualified to instruct us, and to execute well what he has once conceived to be right.

" A piece of ground, 45 toises long, and four toises three feet wide, was made into six beds, to be sowed with only two rows. This spot could not be prepared till the first week in September, nor sowed till the 24th of October. The earth was very dry, and the wheat rose unequally, and made little progress before winter. By a negligence in the first hoeing, almost entire rows of the plants were torn up. In proportion to what was reaped, this little spot would have yielded 180 pounds of very fine wheat.

" A

* It is thought to have destroyed above half of it.

" A measure of oats which was sowed in beds in a proper season, yielded an hundred and twelve measures.

" Encouraged by this success, the same person intends to practise the new husbandry in a larger way. He has already formed about ten acres into beds, which are now sown: and he will continue in 1755, and the following years, to lay out twelve acres a year in beds, till he has disposed all his lands in that manner.

" Another thing intended by this experiment, was, to know whether two rows would not produce a larger crop, in proportion, than three. The success of this promises very fair; but it will be right to continue trying it, and likewise to see what multiplying the rows will do. We shall speak of this hereafter, in order to determine, by real products, what number of rows will best suit this husbandry."

ARTICLE IV.

Experiments made on fields sowed in equally distant rows with the drill-plough, by several lovers of agriculture.

EXPERIMENT. No. X.

" THIS, and the following experiment, were made by the same person who made the seventh, mentioned in our journal of 1752, (p. 153.) the result of which encouraged him to proceed to large ones, and to prove the advantages of this husbandry, by new examples. To be the more exact in these experiments, he resolved to try the old and the new husbandry in the same field.

" For this purpose he chose a field, the soil of which is reckoned equally good in every part. The whole extent is 6727 toises and 18 feet. Of this, 3502 toises 18 feet were destined to be sown in the old way, and 3225 toises to be sown in equally distant rows with the drill-plough. The whole field was equally plowed and dunged, and sowed the same day, viz. the 19th of September, with the same wheat. In short, there was no other difference than in the quantity of seed, and the manner of sowing it.

" The part of this field which was sowed in the old way took up 698 pounds 10 ounces of wheat, which produced 2969 pounds of very fine grain. This is about four and a quarter for one.

" The other part of the field was sowed with the drill-plough, with 243 pounds, which yielded 3187 pounds two ounces of very fine large

large grain'd wheat. The proportion here is, as thirteen to one.

"We find in favour of the drill-plough; first, that though the surface of this ground was 277 toises 18 feet less than that of the other, yet it produced 208 pounds two ounces of wheat, more than the other: and secondly, that, deducting the seed of each crop, this neat produce is still more considerable, as appears by the following account:

Produce of the part sowed in the common way	2969 lb.
To be deducted for the seed	698 lb.
Remains	2271 lb.
	lb. oz.
Produce of the part sowed with the drill-plough	3187 2
To be deducted for the seed	243 0
Remains	2944 2

"Which is 663 pounds two ounces more than the produce of the old husbandry.

"All the field was somewhat damaged by the hail of the 3d of June, which lessened both the crops a little."

EXPERIMENT. No. XI.

"**A**NOTHER field, the soil of which is better than that of the former, having been well plowed, was sowed in equally distant rows, with the drill-plough, on the tenth of October. It contains 2172 toises and 16 feet, was not dunged, and was sowed with 121 pounds eight ounces of wheat, which yielded 2979 pounds of very fine clean corn; which is 24 for 1.

"This return is very considerable, and greatly surpasses that of the foregoing experiment. It should be remembered, that the surface of this field is less. 'Tis true it received no damage from the hail."

EXPERIMENT. No. XII.

"**W**E mentioned in the journal of 1752. (p. 159.) a person's having sown about 150 acres in equally distant rows, with the drill-plough; and we observed, that a great part of the ground could not be well plowed, and that the whole of it could not be sowed till November and December. These two circumstances gave

gave no room to hope for much success. About 40 acres, which were the last sowed, were dunged; but these yielded the least crop of any.

This great extent of ground was sowed with 9932 pounds of wheat. To have sown it all in the common way, would have required 29524 pounds of wheat. Consequently here is a saving of 19592 pounds of wheat, in the seed.

"The soil of these fields being of different qualities, their produce was proportioned thereto, varying from exceeding good to very bad. The 150 acres yielded in all 86058 pounds of wheat. The crop would have been more considerable, if about 30 acres had not been greatly damaged by hail. The loss it occasioned, shews plainly the great probability of having larger returns in other years, when we become more perfect in the practice of the new husbandry, to the want of which the bad success of this first trial has certainly been owing in a great measure. All the lands of this farm are now sowed again with the drill-plough. They consist of about 200 acres, and afford a pleasing prospect for the ensuing harvest."

EXPERIMENT. No. XIII.

"A Field of four acres was sowed in the middle of October with 243 pounds of wheat. It used generally to require about 850 pounds. It yielded 2268 pounds. *This, adds the person who has sent me this account, is as much as I have had from any other field sowed in the old way.*"

EXPERIMENT. No. XIV.

"THE same person who made the foregoing experiment, sowed another field of about four acres and a half, of a poorer and colder soil, towards the middle of November, with 333 pounds of wheat. In the old way, it used to be sowed with 972 pounds. It yielded 1260 pounds. The corn in this field remained thin. It did not branch so well as that of the former. The person who sends me this account of these two experiments, adds: It must be observed, that the drought, as well of the autumn as of the spring, was unfavourable, especially to the late sown wheat. These experiments have encouraged me to purchase a drill-plough, and to sow all my lands with it in equally distant rows, according to the new method, this year 1753: only I have observed to sow earlier,

viz. between the middle of August and the middle of September; and thicker, that is to say, 41 pounds, on the same extent of ground where I sowed but 34 pounds and an half, and 41 pounds and an half in 1752. My plants, hitherto, make a fine appearance, and are very thick: their blades are large, and the whole is in great vigour.

EXPERIMENT No. XV.

"I Have extended my experiments to an estate where I have not time to make any long stay myself, so that what is done there is left to the discretion of servants, whose eye, as is well known, is not like that of the master.

"The lands of this place are very poor: they produce little corn, but very good. In 1752, they were very badly plowed, and this plowing was spoilt by the rains, just as the ground was going to be sowed. I ordered the whole to be sowed with the drill-plough, except two acres, which were sown in the old way. Some few fields were a little better plowed than the rest. These produced pretty good wheat. The others were very poor. However, I have reason to be pleased with my having sowed in this manner. I judge of it by the produce of the two acres which were sown in the common way, and which yielded me no more than exactly the quantity of the seed bestowed upon them.

"The true cause of this was the bad condition of the lands. They are in much better tilth this year. All of them have been sown with the drill-plough, in a favourable season, and my servants assure me that the corn rises finely."

ARTICLE V.

Account of the crops produced during sixteen successive years, by fields cultivated and sowed in the common way, and of which part was constantly dunged; compared with a crop of the same fields cultivated without dung, according to the new husbandry, even supposing them not to yield more than they did in 1753, which was their first crop, and which was greatly diminished by the unforeseen and extraordinary accidents already mentioned.

"THE result of our experiments would be of little use, if it extended no farther than our own private instruction. To render it of more general service, we shall here give a comparison of the

the produce of lands cultivated according to the old husbandry, and according to the new, that every one may judge which of the two will answer best.

"This parallel will shew how much the new husbandry is superior in point of advantage, to the old. We are to suppose all the circumstances of the seasons to be like those of the years of which we have compared the products. But as the expence of culture is an object well worth considering, and as that expence may not be equal in both ways, I beg leave to lay down here as a fact, That the charge of the new culture is less than that of the old. I have tried it, and find it so; as I shall, hereafter, prove beyond dispute.

"By the old culture, in the estate I now cultivate in the new way, I should have had but two fields sowed in 1752, to be reaped in 1753; viz. that of the experiment No. IV, and that of the experiment No. 5. These two fields contain together 22599 toises. I have calculated the produce of these two fields during 16 years, viz. from 1730, to 1745 inclusively. They have yielded eight crops in this time, the total produce of which has been 146863 pounds of wheat; deducting from which 42130 pounds for the seed sowed in the eight years, the neat produce will be reduced to 104733 pounds.

"It is proper to observe, that this wheat was measured every year in the barn, as soon as it was threshed, and before it was sifted: an operation which always occasions a considerable diminution, tho' we make no allowance for it here.

"Let us now see what crops the preceding experiments give us room reasonably to expect from the same two fields in sixteen successive years of the new husbandry; to judge only by that of this first year 1753, unfavourable as it is.

"The field, No. IV, was sowed, half in beds, and half in equally distant rows. I am obliged to suppose it to have been sowed entirely in beds; for it cannot be doubted but that the part which was sowed in rows, would have produced as much as the other: consequently the whole crop of the two halves, at 3370 pounds each, would have been 6740 pounds.

"As the same fields yield a crop every year, in the new husbandry,

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* The fields which were sowed alternately during the eight other years, though their extent was somewhat larger, yielded still less grain. Their whole produce was but 114331 pounds.

we shall have sixteen crops instead of eight: so that multiplying the first year's crop, 6740 pounds, by sixteen, the total produce will be 107840 pounds: to which must be added that of the experiment No. V, which was 2205 pounds; which being also multiplied by sixteen, will produce a farther quantity of 35280 pounds for the sixteen crops. This, added to the amount of the experiment No. IV, will make in all 143120 pounds of wheat for the sixteen years.

"If we afterwards deduct from this the quantity of seed used in these two fields during the sixteen years, which amounts to 8016 pounds, the neat produce will be

135104 lb.

"In the old way, the same fields would produce, in sixteen years, only

104733 lb.

"The difference, in favour of the new culture, is, therefore

30371 lb.

"Besides the advantage of reaping a much greater quantity of corn, there are others which highly merit our attention. This corn is not mixed with any seeds of weeds, and its quality is greatly improved by the abundance of nourishment which the plants are supplied with by the frequent stirrings of the earth in this husbandry, more than in the old.

"But how fine a prospect does the proposition which we advanced before, afford us yet beyond all this! *viz.* That the crops of the second and following years, would be still more plentiful than the first. What some might then think only an object of hope and speculation, is already realized, and proved by experiments. All this deserves the most serious attention. The new husbandry will certainly, in time, acquire a superiority over the old, greater than we can now imagine.

ARTICLE VI.

Proofs that the best field in the country, tho' the greatest part of it was dunged, yielded less wheat than those of the experiments No. II. and XI, in which no dung was used.

"THE proofs of the advantages of the new husbandry cannot be multiplied too much; and all those which are the result of experience, deserve to be communicated to the public.

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"The field we are going to speak of, is generally, and justly, reckoned the best in the country. Its soil is excellent, very deep, and extremely fertile. This field is dunged very often. Its nearness to the farm-yards renders the carriage of manure extremely easy, and is the cause of its getting perhaps more of it than may be necessary. Its situation too is excellent, rising on all sides above the neighbouring grounds, and the high ways which surround it; by which means it is less exposed to be hurt by wet, the water finding an easy drain from off it.

"The extent of this field is 6087 toises. It was sowed in 1752, for the harvest of 1753, and the greatest part of it was well dunged.

"It is not the custom of the country I am speaking of, to describe the extent of a field by the number of arpents it contains, but by the number of measures of wheat with which it is sowed. Eight measures used generally to be employed to sow this: but the quantity of seed was lessened this last time, and only seven measures were sown. We have hitherto supposed the surface of this field to be equal to that of the other fields of the same country, in which eight measures of seed are sowed.

"But as I was desirous to be more precisely exact, in order to form the comparison I purposed making, I had recourse to the geometrical plans of the lands, and found the contents of this field to be, as I said before, 6087 toises: now, the custom of this village is always to sow at least eleven measures in a space like this. One field, among others, very near to this, and which is but 24 toises and 32 feet larger, has always been sown with 12 measures.

"A new cause of the fruitfulness of this field, unknown before my observations, is, that the farmer wisely took care to sow it with a less quantity of seed. The plants thrive better, when the land was not over-stocked with them. This field will therefore help to prove the truth of one of the first principles of the new husbandry, viz. *That the quantity of seed generally used, ought to be diminished*: a proposition which deserves our entire confidence, because the seed here has, time out of mind, been reduced to eight measures, and they have been sufficient to produce very plentiful crops. The farther reduction made in 1752, to seven measures, must also be approved of, since the crop it yielded was very fine.

"These preliminary observations seemed necessary, before we proceeded in our detail. This field was sowed with about 150 pounds of wheat. It was finer during the whole summer, than any wheat

in the common way. It was reaped at a proper time, and yielded about 6646 pounds; from which must be deducted, first the 850 pounds of seed, and secondly, the value of the dung, which is equal at least to 1260 pounds of wheat; together 2110 pounds: which, deducted from 6646 pounds, the total produce, leaves the neat produce 4536 pounds.

"The crop of 1753 was diminished by the hail on the third of June. The value of this loss is not known: but we may fairly compare it with the experiment, No. 2. which likewise suffered by the same hail. We confess that this comparison is not absolutely exact, with respect to this accident: but it must also be granted that this circumstance cannot occasion any very great error. We must likewise premise, that we shall not reckon the produce of a small spot which is pretty commonly sowed in March in the year of fallow, because it hardly equals the expence of dung and plowing.

"The neat produce of the experiment No. 11, on a field sowed in equally distant rows, was 2857 pounds & ounces. But the extent of that field being but 2172 toises, we must calculate what the crop would have been in proportion, if that extent had been 6087 toises, supposing it of the same quality. We shall find that the field on which our experiment was made, would have produced neat 8006 pounds of wheat: deducting from which, 4536 pounds, for the neat produce of the field cultivated in the old way, the difference in favour of the new culture, without dung, will be 3470 pounds of wheat.

"We have seen by the experiment No. 2, that this field laid out in beds, and having borne its second crop, yielded neat 1540 pounds of wheat. Its extent is but 1650 toises; so that we are to see what crop it would have yielded if its extent had been 6087 toises, supposing the quality of the soil to be the same. The rule of three shews us again, that its neat produce would have been 5681 pounds of wheat, which we are to double for the amount of the next year's crop; every year yielding a crop in the new husbandry: whereas the field it is compared with, would lie fallow this year. Thus two years will yield 11362 pounds of wheat; from which deducting 4536 pounds for the neat produce of the same field cultivated in the old way during the same space of time, the difference will be 6826 pounds of wheat, in favour of the new husbandry."

ARTICLE VII.

Reflections and observations on the practice of the new husbandry.

THE chief object of our reflections last year was, the effect which plowing and culture has upon plants. They seem to us to be confirmed by the following observations.

“ 1. The productions were greatest in those places where the earth had been most loosened and brought to the finest tilth.

“ 2. We have seen plainly, that, in order to improve our tillage; it is necessary to make the great furrow in the middle of the alleys very deep, because that furrow being afterwards filled up, and a new bed made over it, there is a greater depth of light well loosened mould immediately under the roots of the plants.

“ 3. We can affirm, that we have this year, without much trouble, plowed our beds from fifteen to eighteen inches deep, which is very considerable: but we must not flatter ourselves, that this depth can always be attained the first year: it is by continuing this same culture that we shall insensibly reach it.

“ 4. To have great success, requires proper care and judgment in performing every part of the new husbandry. The culture which is well executed, will be of very great use; but that, on the contrary, which is badly done, will be of no service to the plants, and may even prove very detrimental to the next year's crop.

“ 5. To perform this culture with advantage, it is therefore necessary to observe this important maxim of tillage, so little attended to by many farmers, *never to set the plough to work, when the earth is too moist*. I have adhered to it strictly, and have never suffered my lands to be touched till they were dry. We have tilled when the weather has been very dry and very hot, and then it was that our culture had the best effect: the stiffest land, having been broken by the preceding plowings, was provided with the moisture necessary for plants, from its surface to the bottom of the furrows; and the plants were sensibly benefited by all our frequent stirrings.

“ 6. I was so struck with it, that I marked several stalks, to see how much they grew each day. From the time that the ears began to appear, till they had done blossoming, I found that they grew an inch in four and twenty hours. The hottest days were those in which the stalks grew most; whilst all vegetation seemed almost suspended in the wheat in the common way.

“ 7. This

" 7. This observation led me to another. I was greatly surprised one day to find my stalks just as I had left them the day before. The next day, and the day after, I found them still the same: in short, they grew no longer from that time.

" So sudden a change raised my curiosity greatly, and I resolved to find out the cause of it. The time when they ceased to grow, was immediately after they had done blossoming. I judged that from that time all the sap was conveyed to the ear to form the grains of the wheat, and that the rest of the plant had only what was necessary to prevent its drying too soon. This dispensation of the nutritive juices seemed to me very remarkable: all their forces seem then to unite, in order to form, fill, and ripen the grain, which is the most useful part. I was afterwards confirmed in this, by observing that it was from that very time that the stalks and blades began insensibly to lose their deep green colour, and that this green grew lighter and lighter every day: a sure sign of a diminution of sap in those parts.

" 8. It is likewise of very great importance to know which is the most proper time for sowing lands: for the growth of plants depends greatly on this circumstance. Late sowings have not answered; but the early ones have produced plants, whose vigour has enabled them the better to resist the winter's cold, and to branch out the more abundantly. By attending to this circumstance, the farmer will enjoy the desirable advantage of having his corn ripen early, and of its being less exposed to the dangers of the summer season; for we have seen that the wheat which was sowed first in the new method, ripened thoroughly as soon as that which was sowed in the old way. It is proper to know this, in order to be sensible of the necessity of beginning to plow early, that the seed may be sowed in due time.

" 9. I must beg leave to make a few reflections again this year on the quantity of seed most proper to be sown. It is of the utmost importance to know how to proportion the quantity of the seed to the strength and richness of the soil, so that each may have its due proportion. The experiments already made, help to direct us; but I think others still necessary before we can trust absolutely to our knowledge in this point.

" At present, I shall only advise sowing the same quantity of seed that I did in 1752. I fancy that proportion will not differ greatly from what a longer practice will shew to be the best. However, the same quantity of seed will not do for every soil. It must be varied with judgment, and regulated according to the circumstances of the
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the season, and the better or worse condition of the ground. I think, too, that in the first, and even the second year of the trials which may be made, it will be proper to sow a little thicker than I did in 1752. The farmer will easily perceive, that when his lands are well loosened and brought to a good tilth, they will require less seed: but till then, he will do well not to be over-sparing of it.

“ 10. We cannot yet determine so exactly as we could wish, what breadth the beds, including the alleys, should be of, to make the ground produce the greatest quantity of corn; nor whether it would be best to sow more or less than three rows. We confess that we should be glad to see a longer series of accurate experiments, and to have a greater knowledge of this matter, before we pretend to fix it. Our beds have always been about six feet wide.

“ Mr. Duhamel, who first introduced this new husbandry in France, intends to make experiments by sowing only two rows. If they should yield more grain, the width of the beds may certainly be diminished: and as it is of consequence to multiply and vary experiments, in order to determine this point, we now have several beds sowed, some in two, and some in three rows. I have likewise tried what multiplying the number of rows in some fields would do; and the result of this experiment promises an advantage in that way of sowing. The success of this first trial was as follows.

“ When the field of the experiment No. 2. was sowed, I observed among the rest ten beds which the plowman had made wider than the others. I was sorry at first, that any part of the ground should be lost: but upon thinking farther of it, I determined to sow those beds with two turns of the drill-plough, and consequently to plant them with six rows of wheat. I did so: and when the first plowing after winter was given, little regard was paid to the two outside rows, which were torn up by the plough in several parts, so that there remained but four or five rows in those places.

“ The wheat of these beds grew as high and branched as much as that of the others, in which there were but three rows, not excepting even the middle row. I examined them frequently, with great care, and was assisted therein by several persons very capable of judging and making good observations. The only difference we could distinguish, *and that was scarcely perceptible*, was in the ears, which we thought rather the shortest in the middle rows: but as there was a greater quantity of them, we judged that these beds would yield most grain.

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"We were not mistaken; for their produce was as follows. The ten beds which had been sowed with six rows each, yielded 91 pounds of wheat more than ten beds which were sowed with three rows each. But, as this result does not set the matter in a sufficiently clear light, we must have recourse to the following calculation. The six row'd beds took up more ground than those which had but three rows: two beds more might have been made out of the surplus of their breadth: so that there would in that case have been 12 beds instead of 10. The question therefore is, whether this ground, made into 10 beds, produced more than it would have done if it had been made into 12 beds of three rows each. To which I answer, that it did produce 38 pounds more: and that there was likewise a seventh part more straw.

"As this experiment deserved to be repeated, I have tried it in a larger way. I have laid several acres out in beds of about seven feet wide: they are sowed with six rows: the plants are very fine, and I impatiently wait the event.

"Though I have continued not to dung my fields, the plants still grow very tall, and produce fine long ears, well filled with plump grain.

"I am indebted to the new husbandry for the recovery and improvement of worn-out meadows. They have already yielded me plenty of fodder. The value of this should be added to the produce of the fields; because the new husbandry is the immediate cause that manure can be spared to enrich those meadows.

ARTICLE VIII.

General disposition of the lands for the crop of 1754.

"THE more I have studied the principles of the new husbandry, the more I have been convinced of the advantages attending it. My experiments have not only confirmed me in this opinion; but they have likewise shewed me that my practice has been consistent with those principles. This made me determine to lay the whole of one of my farms out in the new way, as soon as possibly I could; its extent being no more than I can direct almost all the whole culture of myself.

"I have compleated it this year. All the fields, of which only half used to be sowed every year in the old way, are now laid out in beds. I have sowed them all, with a design to continue doing so

for the future every year. They look exceeding well hitherto: the plants are extremely fine, and promise a greater crop next year, than that of the experiments of the foregoing years.

"These experiments have likewise made a strong impression on several persons in this country, each of whom judged of the new husbandry, as his inclination, or prospect of advantage, directed. 'Tis true our farmers are more generally inclined to sow their land in equally distant rows, with the drill-plough, than to lay them out in beds, the proper management of which, say they, is attended with much more care and trouble. My drill-plough is preferred on account of its simplicity. It began to be used last year, and numbers of fields near this city (Geneva) have been sowed with it this year.

"Several of our peasants have likewise tried the drill-plough, and their example will be of consequence hereafter. Their unwillingness to come into any new practice, is well known: but this seems to get the better of their prejudices; and the prospect they now have of greater crops than usual, makes them regret their not having sowed a greater extent of ground this way.

"We have about an hundred and fifty acres sowed in beds, and near a thousand sowed in equally distant rows. Such large experiments, and made on different soils, cannot but afford new instruction: the facts will be better ascertained, and people will be more thoroughly convinced that the greater produce of the crops is owing to the new husbandry, and not to favourable circumstances, to which they are too apt to impute it. These experiments, say they, have been made on the very best soils; it is much easier to prepare a rood or two of ground, than an extent of several acres; these little spots have been cultivated with vast care; it is almost impossible to bestow the same attention on large tracts of land.— Luckily, several lovers of agriculture are making large experiments, which already prove that the new husbandry may easily be practised in any extent of ground whatever.

CONCLUSION.

"ANY one may now judge, by the experiments which have been made these last four years, and by the success which has attended them, how far the principles of the new husbandry are justly founded, and how far we are in the right road to give still farther demonstrations of their excellence.

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“ The lands on which it has been already practised, leave no room to doubt that all its operations may be performed with ease : and at the same time they prove to every one who shall be inclined to cultivate any part of their farms in the same way, that they may do it with equal advantage.

“ Convenient instruments for executing this culture are already invented and made. The use that has been, and still is made of them, ought to increase our confidence in them. It is by their means that the two most essential articles towards securing success, are obtained : the first is, the means of forming, plowing, and cultivating the beds, with great ease and little expence : the second, that of sowing land more regularly, and of giving it the exact quantity of seed that may be thought most proper, by means of the drill-plough, which buries the seed at its proper depth in the furrows, covers it over, and, in short, does the whole business of sowing with great dispatch, and a considerable saving of seed.

“ The chief obstacles being now removed, we may reasonably hope that the new husbandry will gain ground every year. Numbers of intelligent persons, truly zealous for the public good, have seen how my lands were cultivated, and have been curious enough to be present at all the operations of this culture. They have frequently told me, that the public have not a right notion either of the new husbandry in general, or of the ease with which it is performed. They themselves have wondered at it, and pressed me to publish a circumstantial account of the manner in which I have introduced this new method in our country, that they too might instruct their countrymen therein. I have yielded to their solicitations ; and shall continue to communicate my farther observations in this fourth year of my practice of the new husbandry.

SECTION IV.

Experiments made by M. Lullin de Chateau-vieux, in the year 1754.

“ MY experiments in the year 1754, will afford a fresh proof of what I said in my accounts of those of the preceding years, viz. that land, by continuing to be cultivated in the new way, will become more fertile, and produce greater crops even the second or third year ; because the earth will then be in a looser state, which is highly necessary to procure plentiful productions.

“ This proof ought to be received with so much the more confidence

fidence, as the seasons of the year 1754 were not favourable to the production of corn. It was an extremely dry year; the earth had not the degree of moisture which is necessary to promote the growth of plants; the wheat was in general very thin and low, and numbers of farmers did not reap above half the crop the same lands yielded them in 1752.

"The wheat suffered great accidents early; for it was *rusted* in October and November. Till then, it was very strong, and promised well; but afterwards, it turned yellow on a sudden. The *rust* made a great progress. I met with places where the ground was entirely covered with the powder of this distemper. The vegetation of the plants before winter, was from that time nearly at a stand.

"They were likewise hurt, and perhaps still more, by the frosts which began again in March, and lasted till the 20th of that month. These frosts rooted up prodigious numbers of plants of the wheat sowed in the common way, which withered in a few days. Some fields suffered so much by this accident, that they were obliged to be plowed anew, and sowed again with oats or other spring corn.

"To shew the result of my experiments the more distinctly; I shall range them in the following order.

"The first article will contain an account of three experiments made on lands laid out in beds, and which have borne a third and a fourth successive crop; to which I shall add some remarks particularly relating thereto.

"In the second article, I shall relate four experiments which I made on lands formed into beds, which had borne a second crop. These too will be accompanied with some reflections.

"The third article will give an account of three experiments made on lands formed into beds, which have borne a first crop; and of the manner in which I tilled them, in order to prepare them for sowing. This will give rise to several remarks.

"The fourth article will inform the public of some other experiments made on lands laid out in beds, which have yielded a first and second crop. This will be followed by some interesting observations.

"In the fifth article I shall relate several experiments made by divers lovers of agriculture, on lands sowed in equally distant rows with the drill-plough.

"The sixth article will contain an account of the produce of several fields sowed in equally distant rows, with the drill-plough.

"In the seventh, I shall make some general observations on the experiments contained in the foregoing articles.

"I shall speak in the eighth article, of the experiments I have made on beds sowed with six rows of wheat; and compare their produce with that of others, sowed with only three rows. The result of this will enable us to judge how many rows it may be best to sow.

"In the ninth article, I give a circumstantial detail of an experiment which I made in order to be more sure of *the best way of sowing the beds*; and to be able to determine more exactly what quantity of seed is most likely to produce the greatest crop.

"Before I enter upon either of these subjects, it will be proper to observe, that I have used no dung, or any sort of manure, for my fields or beds; purposely to be the more certain of the effects of this new culture, and to see what land could do by mere dint of stirring it. My dung has been laid, as usual, upon my grass lands, where it continues to be of wonderful advantage.

"I shall use the same weights and measures as in my former experiments, *viz.* the toise of thirty-six feet, and the pound of 16 ounces.

ARTICLE I.

Experiments made on lands formed into beds, which have yielded a third and a fourth successive crop: with some observations particularly relating thereto.

EXPERIMENT, No. I.

N.B. *This field is marked with the same number in the journals of 1751, p. 139; 1752, p. 145; and 1753, p. 160; and is the spot on which I made my first experiment in 1751. This is the fourth successive crop.*

"THE small spot of ground on which I made the experiment I am going to speak of, being only a single bed, 160 feet long and five feet wide, would not deserve to be taken notice of in this account, were it not for a circumstance extremely remarkable, and the more worthy of attention, as the success it was attended with, affords an unexpected and indisputable proof of the fruitfulness which may be expected from lands cultivated in the new way. If farmers will but

continue it to the third or fourth year, they will then be sure of having their land in excellent tilth, well loosened and divided, and its pores properly opened and exceedingly multiplied. That this will be the case cannot be doubted. Yet some may perhaps be weary of cultivating their lands for so long a time, before they attain that perfection of culture, which we have all along declared to be necessary, in order to have great success.

"To prevent the disgust which might arise from so distant an expectation, and to encourage the lovers of the new husbandry, I shall observe in the first place, that there are, in every country, considerable tracts of good land, which will not require so long a time to bring them into proper tilth. I am, however, sensible how serviceable it would be towards hastening the progress of the new culture, in lands of an inferior quality, to be able to find out some shorter way of breaking and loosening the earth: and accordingly I have tried whether it cannot be done.

"I have succeeded therein, fully to my satisfaction, and can now say with certainty, that lands may be brought to a sufficiently loose state, even the first year, by plowing them in the manner I shall explain in the third article, experiments 8, 9, and 10, the crops of which were very good.

"The most certain, and most incontestable principle of the new husbandry, is that *the earth must be thoroughly loosened by deep and frequent plowings and repeated culture.* In consequence of this, I examined very carefully whether my lands were more loosened and rendered lighter by my manner of performing the operations of the new husbandry, than they were when cultivated in the common way. All my observations convinced me that they were.

"The first glance of the eye shewed me, that the surface of my lands were smoother: on sounding the plowings, I found them deeper: less strength was required to plow; two horses, and sometimes only one, or a single ox, did with ease, what would otherwise have required at least double that number of cattle. A manifest proof that my lands were in excellent tilth.

"If, after having thus examined the lands themselves, I considered their productions, I had a fresh proof of their being brought to that state of pulverisation, in which alone plants can thrive well. My wheat was infinitely stronger than that in the common way; and, on examining it minutely, I found that each plant had a greater quantity of roots, stronger, thicker, and much longer, than other wheat, and that

that the blades were broader and longer, and of a much deeper green. The plants had generally a great number of very thick and long stalks which were crowned with large ears quite full of grain, and much heavier than those of the common wheat.

"All these observations were sufficient to convince me, that my lands were in the state I wished them to be; that is to say, that they were loosened and divided so as to be capable of yielding great productions.

"It was therefore less to satisfy myself, than to give the public a farther proof of the excellence of the new husbandry, that I made the experiment I am going to relate. It was an interesting one in every respect; and I do not doubt but that it will induce many others to make the like trial. I can assure them, that they will find it well worth their while.

"The harvest of 1753 being over, I immediately set about plowing my fields, and forming the new beds which were to be sowed. The year was a very dry one. I used frequently to walk both over the beds that had just been reaped, and over the fields cultivated in the common way, where the corn had likewise been lately cut down.

"The first thing that struck me in these walks, was, the difference which I found in the stubble. That of the fields cultivated in the common way was so poor and weak, that it scarcely opposed the motion of my feet. That of the beds, on the contrary, resisted greatly: I often felt it break under my feet, and frequently met with tufts of 20, 30, 40, and sometime more stalks, which stopt me short, like so many little bushes.

"I am the more particular in my account of this stubble, because it shews the great strength of the plants; which they would not have had if the earth had been less well prepared. Besides, this stubble has its real use, as I shall shew elsewhere. *It is a much better manure for land than the common stubble is.*

"This observation led me to examine carefully what other differences I could find between the fields cultivated either way. The most important is, the state of compression which those in the common way were in after harvest. They offered nothing pleasing or satisfactory to the eye: the earth was extremely hard, close and compact; and its surface almost as firm as that of a beaten road.

"The fields in the new way, prepared by better plowings made at proper seasons, were, on the contrary, still very light and soft in the middle

middle of the beds, in the partitions between the rows of stubble. The earth gave way like sand, when trod upon; and *though it was very dry*, I thrust a stick of green willow eight or ten inches deep into it, with great ease, though I could not by any means push it at all into the land which had been cultivated in the common way. This plainly shews the better state of the former.

"Lastly, I compared these fields with those that were in fallow, which had been plowed, and were intended to be sowed in autumn. I found the tops of the late reaped beds, in much better condition than the common fields which were under fallow. This made me immediately conclude, that these very beds might be sowed again with success, in the same places where the corn grew the year before, *without plowing them*.

"I thought, however, that if this experiment did succeed, it would be owing in some measure to the culture of the alleys, and that this would fully prove the use they are of. This was another reason for my trying this experiment.

"It appears by this, that my chief design was to try whether the same ground could be sowed, in the same place, two years running, without plowing; and to see how strong the plants would, in that case, be at harvest.

"I was consequently to avoid, in sowing it, every thing that might supply the want of plowing, and to stir only just so much earth as was absolutely necessary to bury the seed. This consideration prevented my using the drill-plough, the share and harrow of which divide and loosen the earth perfectly well, as deep as the seed is planted.

"All I did to this bed, was, barely to pull up the stubble, and afterwards draw a line with a stick, as if it had been for sowing lettuce. The seed was dropt by hand into three of these channels which were afterwards covered over with a rake.

"The birds had done great damage to the wheat I sowed the year before in this ground. To avoid this accident now, I sowed a kind of corn called *spelt*, which is used in many places instead of wheat. The Germans cultivate it greatly. The spelt which I sowed is of a somewhat different kind. The grain of both sorts is inclosed in double husks, very thick, and of which the outer one does not open easily, so that the birds cannot pick out the grains.

"I sowed this bed very thick, concluding that the plants would not branch much. And I sowed it early, *viz.* on the nineteenth of July, because

cause this grain remains a whole year in the ground, from the time of sowing, till it is ripe. I used in all eleven ounces of seed, which soon sprung up, and the plants made very strong shoots; but I judged them too thick.

“As this ground had not been plowed, I thought it was proper to assist the plants otherwise as early as I could. I had them weeded on the twenty-second of August.

“These plants grew so extremely thick, that their blades covered the ground four feet round, before winter, in such manner that the earth could not even be seen through them. The rows were from a foot to a foot and an half high, and the whole had already spindled, which made me sorry I had sowed so early: fearing lest plants so forward before winter, as these were, should be killed by the frost; and, in order to secure some resource in case that should happen, I ordered part of the bed to be mowed the sixth of November, but did not touch the rest. I must here observe by the way, that *the part which was mowed had fewest stalks at harvest.* At the same time I gave the alleys their first plowing before winter. Upon opening a furrow near the rows, I saw so prodigious a quantity of long roots, interwoven as it were with one another, that I continued to hope well of the success.

“Seeing, however, so many roots uncovered and exposed to the air and frost, I was tempted to fill the furrows up again, in order to preserve them from it: but, considering that, by leaving the furrows open, the part of the bed in which the plants were, and which had not been plowed, would be much more exposed to the frost, which would then penetrate the earth through its surface, and through both sides of the furrows, whereby it would be greatly divided, and perhaps meliorated more than by plowing, I preferred leaving the furrows open, and have had no cause to repent it.

“I considered too, that supposing these roots exposed to the air should perish, which was no more than what I might reasonably expect; the plants had other roots on t’other side, which, still remaining covered with earth, would be sufficient to supply them with the necessary nourishment till spring.

“After winter, the plowings were performed in proper weather, and the bed was weeded. I shall not repeat the detail of these operations, either here or in the following experiments. What I said of them in the year 1753, may suffice, as they have not been varied since.

“The

"The plants I have been speaking of, grew amazingly in thickness, height and largeness of ears. They were reaped the twenty-sixth of July, and yielded five hundred and forty ounces; which is forty-nine times the seed, and an ounce over. The birds did no damage at all. This is after the rate of 2041 pounds, or about 93 bushels to an acre, which is a very great crop.

"This experiment amounts to a complete demonstration of the superiority of the new husbandry. It shews, beyond all doubt, how much the earth is more perfectly tilled by it, and that this tilth is lasting, if care be taken to preserve it by good culture, performed at proper times and with judgment.

"Can it be thought that a field cultivated in the old way, will, with only pulling up the stubble, and without plowing it several times, even tho' it be harrowed, ever produce a crop of any corn whatever? Part of the seed might indeed shoot, and the plants might grow some inches high: but they would certainly perish for want of nourishment, which they would not be able to draw from such a soil, by reason of its extreme hardness; and consequently they never would be able to produce any grain, which is the great object of agriculture.

"It was of great importance to shew, by an unexceptionable experiment, that lands are brought to much better tilth by the new husbandry than by the old. This is now completely proved; and no doubt can any longer be made, that the consequence we drew from it is equally certain; *viz. that lands so prepared, will produce more than lands which are cultivated in the common way.* This fact, which is founded on the principles of sound philosophy, is likewise confirmed by repeated experience.

"The partisans of both kinds of husbandry will do well to consider, that the great principle which we are endeavouring to inculcate, and on which almost the whole success of the new husbandry depends, is admitted in the old husbandry: *viz. thoroughly to divide and loosen the earth.* This principle is so generally received, that there is not a husbandman who does not know that one plowing more than ordinary does his land as much good as dunging it would do. His experience has certainly taught him, that this extraordinary plowing produces him better crops: but he is not sufficiently sensible, that of all the ways of improving his land, no one is more effectual, or less expensive than this. Were the full value of it known, it

would be practised more; and every farmer would give all his lands at least one plowing extraordinary.

"What we propose, is therefore not a novelty capable of giving any husbandman the least dislike to the new husbandry. We all proceed upon the same principle, and agree as to its effect. All of us say, *the earth must be well divided and thoroughly loosened*; but we differ in the manner of doing it. We propose a method by which the ground is much better prepared than in the old way. In this consists all the novelty. Whoever rightly considers it, and compares it with the principles and experiments, will readily receive it: but he that is determined beforehand not to enter into this examination, will never enjoy the benefits of it, but will continue plodding on in the old beaten track; not from reason, but because others did so before him.

"The advantages of the new husbandry are however so great, that it would be doing the public an injury, not to endeavour to make them more and more known. The fittest way to answer this end, seems to be, to exhort all husbandmen to convince themselves, by studying the theory of the new husbandry, weighing the solidity of its principles, and consulting the experiments which have been already made.

"Every man of common understanding, cannot but succeed in the practical part; and his example being imitated by others, the new husbandry would soon become the general method.

EXPERIMENT, No. H.

N. B. *This field is marked with the same number in the Journals of 1752 and 1753.*

For the crop of 1752, (p. 147.) it was sowed with 11 pounds 4 ounces of wheat, which yielded 1041 pounds 12 ounces.

For the crop of 1753, (p. 161.) it was sowed with 34 pounds 14 ounces, which produced 1575 pounds.

For the crop of 1754, it was sowed with 61 pounds 14 ounces, which yielded 1820 pounds.

"THIS field, which was to be sowed for the third time, having been brought to a good tilth by former plowings, I prepared it immediately after harvest, by giving it a plowing like that of last year. I found I had done right in increasing the quantity of the seed the second year: and upon examining the plants which the earth

earth had nourished, it seemed to me that it could yet bear a greater number, and that I might still expect a greater crop, by adding to the seed.

Accordingly I sowed it on the sixteenth of August, with 61 pounds 14 ounces of very large and perfectly clean wheat, of my own growth. It was the same that I used for sowing all my fields.

The plants made a very considerable progress after winter, and shot up greatly, notwithstanding the extraordinary drought. They began to spindle the eighteenth of May, they blossomed the first of June; and, being ripe, I cut them down the tenth of July.

"I had them threshed a month after harvest. They yielded 1820 pounds of perfectly clean wheat. Thus we see that this field produced in 1754, 245 pounds more than in 1753, and 778 pounds 4 ounces more than in 1752.

EXPERIMENT. No. III.

N. B. *This field is marked with the same number in the Journal of 1753. (p. 165.)*

"**T**HIS field being now in much finer tilth than it was last year, would certainly have produced a greater quantity of wheat. However, I resolved to sow it with a foreign wheat, by way of trial. I did so, and it yielded me scarce any crop at all.

"I thought it might be of great service to try whether wheat of a different quality from that which we usually cultivate, would not yield more than even wheat of the growth of our own country. At all events it was right to make this trial, tho' the wheat I used for it was by no means proper for sowing in our land. It was Sicilian wheat, the grain of which is very large and extremely hard. I sowed it on the twenty-first of August. It rose well; the plants grew very fine before winter, and were extremely thick. But this wheat, being doubtless of a much tenderer nature than our common wheat, could not resist the winter's frost, which almost entirely destroyed it. Only a few strong plants escaped. They grew exceeding fine, branched greatly, and produced very large ears, which contained more grains than those of our own country wheat. As the plants which survived the frost were very few, I reaped only about three times the seed.

REMARKS on these EXPERIMENTS.

"IT is by experience that we can best judge how far the advantages ascribed to the new husbandry are real. The foregoing experiments give rise to two important observations.

"The first experiment shews us, that lands are brought to much better tilth by the new husbandry, and that they will consequently produce much larger crops, than in the old way. Experience proves that they have done so.

"The second experiment offers us the same proofs, but upon a much larger extent of ground. We have the produce of three succeeding years, and the gradation of their crops. What ought to be particularly attended to here, is, that as the internal pores of the earth became more open, the crops became more plentiful; which justifies what we said before, that the crops of the second, third, and following years, would be greater than that of the first.

"It was of great consequence to establish this fact, in order to found our calculations of the products on certain and approved experiments. The following article will afford still farther proofs of this truth.

ARTICLE II.

Experiments made on lands laid out in beds, and which had borne a second crop. Reflections on these experiments.

EXPERIMENT. No. IV.

N.B. *This field is marked with the same number in the Journal of 1753. (p. 167.)*

For the crop of 1753, it was sowed with 181 pounds of wheat, which produced 3370 pounds.

For the crop of 1754, it was sowed with 268 pounds 14 ounces, which produced 4972 pounds 8 ounces.

"I Must remind the reader, that this field was sowed in 1753, half in beds, and half in equally distant rows with the drill-plough. I shall speak first of the part that was laid out in beds, which continued to be cultivated in the same manner for the crop of 1754.

"The plowings made during the year 1753, had the same effects on

on this land, that is to say, they loosened and divided it. It was plowed with ease after harvest; and the new beds having been formed and well prepared, I sowed them on the seventeenth and eighteenth of August, increasing the quantity of the seed to 268 pounds fourteen ounces of wheat. The plants rose well, and throve greatly before winter; and in the spring they made strong shoots.

"The winter's frosts, and perhaps some insects too, had destroyed several plants in the rows. I saw plainly by this, that I had done right in increasing the quantity of the seed. Though the year was dry and hot, the wheat grew to a great height, and ripened well. I reaped it between the tenth and fifteenth of July, and threshed it out in the winter. This crop yielded me 4972 pounds 8 ounces: so that I had this second year 1602 pounds 8 ounces more than the first.

"I shall shorten what I have to say of the other half of this field, which was sowed in equally distant rows for the crop of 1753. After harvest, I made it into beds. But how surprising was the difference between the mould of these two parts of the same field, even in the second year! That which had been in beds, was fine and light: but this was scarcely divided at all: it was full of great hard clods, many of which were obliged to be broken by hand. Though I had not much hope of its yielding any great crop, considering the condition it was in, I sowed it on the twenty-ninth and thirty-first of August.

"These beds were but poorly stocked with plants, which gathered little strength before winter, and indeed always remained very weak and stunted, and when reaped, yielded still less than the other half of the field had done in 1753. But if I have gained nothing by the crop, at least I have brought my beds into such tilth, as assures me of a more plentiful harvest in 1755.

EXPERIMENT. No. V.

N. B. *This field is marked with the same number in the journal of 1753. (p. 170.)*

For the crop of 1753, it was sowed with 139 pounds, which produced 2205 pounds.

For the crop of 1754, it was sowed with 224 pounds of wheat, which produced 2283 pounds.

"THE soil of this field was of such a nature as made it more difficult to loosen, than those of the experiments No. 2. and

No. 3, notwithstanding the culture bestowed upon it in the summer of 1753, which mended it greatly. Still it was not yet in the condition I could have wished, when I sowed it on the eighteenth and twentieth of August. I sowed it thicker than it had ever been before, purely on account of the badness of its tilth. I bestowed upon it 224 pounds of wheat, which rose pretty well, but afforded fewer plants than that of the second experiment. They branched tolerably, and their ears were very fine. I reaped this crop on the nineteenth and twentieth of July, and it yielded 2283 pounds of wheat, which is 78 pounds more than the first crop in 1753.

EXPERIMENT. No. VI.

N. B. *This field is marked with the same number in the journal of 1753, (p. 170.)*

For the crop of 1753, it was sowed with 45 pounds of wheat, which produced 724 pounds.

For the crop of 1754, it was sowed with 82 pounds of wheat, which produced 798 pounds.

“**W**HAT I said of the foregoing experiment, may likewise serve for this. All the circumstances were alike, except that this field was sowed a few days later, viz. the twenty-seventh of August. It was reaped on the nineteenth of July, and yielded 798 pounds, which is 74 pounds more than in 1753.

EXPERIMENT, No. VII.

N. B. *This field is marked with the same number in the journal of 1753. (p. 170.)*

For the crop of 1753, it was sowed, as well in that part of it which was made into beds, as in that which was sowed in equally distant rows, with 412 pounds of wheat, which produced 2646 pounds.

For the crop of 1754, the whole field was made into beds, and sowed with 360 pounds, which produced 2467 pounds.

“**I**T must be remembered that one half of this field had borne a first crop, and the other a second. From what I have already said, it will be presumed that the mould of the new beds was not in so good condition as that of the other beds: consequently the former could not be expected to yield so good a crop.

This

"This field was sowed on the twenty-first and twenty-eighth of August. Its whole extent took up 360 pounds of wheat, which yielded a crop of 2467 pounds. At first sight, it seems to have yielded less now, than in 1753: but it must be observed, that the beds of this field were of two different ages: those which now bore their second crop, yielded more than in 1753; but as the sheaves were not collected separately, I cannot tell exactly the difference of their produce.

Reflections on the experiments contained in this article.

"I Have now given an account of four fields, which produced their second crops in 1754, all of which were greater than those of 1753, and especially that of the fourth experiment. I am fully satisfied that their produce was proportioned to the preparation of the soil. This observation shews of what consequence it is to divide and loosen the earth as much as possible, by deep plowing and thorough hoeing, in order to bring it to a perfect tilth; which may certainly be done, and that in a short time, by the means which I shall point out in the following article.

"Neither our interest, nor the knowledge we would acquire of the products which the new husbandry is capable of yielding, suffer us to rest satisfied with knowing, for example, what the crop of these four fields was the second year, and looking upon that as the most they will ever produce. We ought likewise to examine whether their crop was not diminished by causes which we can account for, and which we may reasonably hope will not take place in other years.

"By this examination we shall find, that the year was not a good one for great crops of wheat. There was not rain enough: the corn grew thin, and yielded but few sheaves. The ears were indeed full of grain, but the quantity was not sufficient to make amends for the thinness of the crop.

"The wheat was *rusted* in autumn; and though this distemper shewed itself in that season, in which I think it does the plants least hurt, yet it prevented their branching, so much as they would otherwise have done, the next spring. I observed exactly, that the thinnest places were those where the *rust* had prevailed most. Lastly, the frosts which happened in March, did great damage to the wheat. It is therefore not to be wondered at that the crop was not greater. I hope, and, I flatter myself, not without foundation, that the same fields

fields will produce better crops in years exempted from such accidents.

" I do not pretend that the new husbandry can secure corn from the effects of all these accidents : but I have experienced that it has suffered less from the intemperature of the seasons, than that which has been sowed in the common way : for instance, it will suffer less by a great drought, or even not be at all affected by it, if dews fall, which penetrate the well-loosened earth ; as I have constantly observed : and besides this, the roots of the corn in the new way, being much longer, will extend to a considerably greater depth in ground that has been plowed deeper ; and will find a moisture there, which corn in the common way is deprived of.

ARTICLE III.

Experiment made on lands laid out in beds which had borne a first crop : with an account of the manner in which they were tilled, to prepare them for sowing. Remarks on these experiments.

" **T**HE first crops of all my fields laid out in beds, have hitherto been but small. I easily discovered that this was owing to two principal causes, independent of the intemperature of the seasons. The first was, that I sowed too little seed at first, and that the quantity was not sufficient to bear the accidents which beset my wheat, without being considerably diminished thereby. This I remedied afterwards, by increasing the quantity of the seed ; which I have continued to do by little and little, from year to year, in proportion to the condition and quality of my land.

" The second cause was the bad condition of my lands, which could not be sufficiently loosened and divided in so short a time, and therefore did not afford the plants the quantity of nourishment necessary to enable them to produce plenty of grain.

" I was in hopes, that by continuing my plowings, I should have better success the following years : that is to say, that I should bring my land to a looser state, and that if I gained that point, the crops would certainly be greater afterwards.

" Encouraged by this expectation, and provided with my plough and cultivators, I made no doubt of succeeding. To this end, I resolved to multiply the plowings : and certainly no one ought ever to hesitate so to do, even in the common husbandry ; so great have been the effects produced thereby.

" I have

"I have often reflected on this passage in Mr. Du Hamel's treatise of the culture of lands: *One of the President Montesquieu's farmers reaped a great crop of Spanish wheat, from his farm near Clairac, at a time when all his neighbours crops were very bad. The President asked him, what he had done to have such extraordinary success. The farmer answered, that he had plowed his ground eleven times between seed-time and harvest; and that by this means he had reaped the benefit of all the rains, dews, fogs, &c. whilst his neighbours lands were not at all bettered by them, on account of a dry hard kind of crust, which grew over their grounds, for want of plowing. This observation agrees perfectly with the principles on which the new husbandry is founded.*

"This shews us that an active, intelligent, and industrious farmer will always reap the fruit of his labour and expence. But without pretending to say that land ought to be plowed quite so many times, we learn from this example, that it would be greatly for the public good, to plow it oftener than it generally is.

"I multiplied my plowings, in the spring, and till seed-time. I gave my land six plowings in all: but I ascribe the great benefit I received, chiefly to the manner in which those plowings were performed, and to which I beg the reader seriously to attend.

"After the beds were formed, my method was this. I changed their position by removing the middle of the beds to the place where the great furrow in the middle of the alley was; or, to make myself better understood, I performed the same plowing that we do after the first crop is reaped.

"This operation is of such importance, that it requires my being still more explicit. I shall therefore relate the whole preparation that I gave my land. In the first place, I plowed it twice, as deep as possibly I could, in broad lands. The beds were formed at the third plowing. I afterwards gave a fourth plowing, to raise them still higher, by opening the first furrow in the middle or highest part of the beds, and turning the earth on both sides up against that middle, by which means the beds were arched very high, and a great furrow was left in the middle of the alleys. I went farther yet; and this I ought to reckon as a seventh operation: I cut the great furrow in the middle of the alley still deeper, with one turn of my cultivator with two mould boards.

"The beds thus prepared, were certainly in good order to be sown.

ed: I never had them in so good condition before: but I was willing to go still farther; and that for the following reason.

"I had observed that there is always a greater depth of fine mould in the middle of the bed, when it is placed in the space before occupied by the great furrow in the middle of the alley. I had not disposed my beds in that manner till the second year.

"I therefore thought it advisable to change the place of the beds. I did so, at the fifth plowing, by filling up the great furrow, which now became the middle of the new bed. The earth being in a very loose state, a great deal of it was heaped up by each turn of the plough, with ease to the horses, and with speed. The middle of the beds was raised as much as might have been thought necessary: but I raised it still higher, by the sixth and last plowing, by cutting the first furrow in the middle of the bed, and turning the earth up from right and left towards it.

"By these plowings, the mould of the beds will be admirably well prepared even the first year, and the seed sowed therein will not fail to vegetate very abundantly. It is by this means that I have brought the middle of my beds to the depth of 15 or 18 inches of fine loose mould, in which the perpendicular roots of the plants extend themselves and multiply easily, and find plenty of nourishment, which they afterwards transmit to the plants themselves.

"I shall mention farther, as a proof of the fineness to which these plowings brought the earth, that I was not obliged to harrow my beds, before I sowed them.

"Some may perhaps object, that all this requires much labour, great trouble, and considerable expence: and how, will it be added, can one find time for so many plowings?

"To this I answer: first, that allowing all this to be true, the crop will make very ample amends for it. What follows will establish this truth beyond all doubt.

"Secondly, that this labour ought not to discourage any one. The four first plowings are absolutely necessary, as all will agree; and the fifth and sixth are performed with such ease, and in so much less time than the common plowings, and especially the last, for which one horse will generally be sufficient, that it will easily be perceived I do not propose a thing either too difficult or too expensive to execute.

"The fields of the three experiments in this article, were prepared in the manner I have now related.

E. X.

EXPERIMENT. No. VIII.

"THE soil of this field is very good and strong. Its extent is 1300 toises. I made the beds about six feet wide; and each bed was sowed with two turns of the drill-plough, which were to make six rows: but the difficulty of guiding the plough so as to keep the three last rows exactly parallel to the three first, was so great, that the two middle rows were frequently jumbled together, so that there were in fact but five rows in some places. The space that remained between the outer row of one bed and the outer row of the next bed, left an alley wide enough to be plowed. I must observe that our farmers hereabouts liked this way of sowing much better than the first, in which I likewise made the beds six feet wide; and sowed them with only three rows.

"I sowed each row a little thinner than in the former experiments: but as there were more of them in each bed, they would of course require a greater quantity of seed. This field was sowed on the twenty-seventh of August, with 76 pounds 8 ounces of wheat.

"All my plants were equally fine till winter, and shot up with great vigor in the spring. They grew exceeding high, branched abundantly, and produced very large ears, among which there was but little difference. This crop was reaped on the seventh of July, and yielded 1462 pounds of wheat.

"This produce made me ample amends for the labour I had bestowed upon the ground. It is after the rate of about 1500 pounds, or 30 bushels to an acre.

EXPERIMENT. No. IX.

"THIS field is of a very indifferent quality, and had hitherto yielded but small crops. Its extent is 5813 toises 12 feet. It was sowed on the seventh and eighth of August, in the same manner as the former, with 249 pounds 12 ounces of wheat.

"The young plants shot up as thick, and looked as strong and of as good a colour, as those of the foregoing experiment: but the rust took them all in October and November, and their blades, which were of the finest green before, turned yellow, and perfectly covered the ground with the powder of this rust. My plants suffered greatly by this accident. They branched imperfectly, and consequently grew

very thin. Their stalks were, however, long, and bore fine ears. They were reaped on the 8th of July, and yielded 2925 pounds of wheat.

EXPERIMENT, No. X.

"THE soil of this field is rather inferior, than equal to that of the field we spoke of last, whose fate it likewise suffered in every respect. The young plants were extremely fine, and, in October and November, they were rusted almost as much as the others. This field contains 4919 toises. As I thought this land inferior to the other, I sowed it thicker; using to this end 294 pounds of wheat. It was sowed on the 8th, 17th, and 28th of August; not being able to do it in any three days running. The crop yielded 3055 pounds.

Remarks on these experiments.

"I Have now been able to obtain better crops, even the first year, by the new husbandry, than any I ever had before. I think there can be no doubt but that this success is owing first, and chiefly, to the better preparation of the ground: and secondly, to the proper increase of the seed. Upon the whole, I am inclined to think, that the sowing each bed with two turns of the drill-plough, increased the crop. But of that I say no more at present, as I intend to treat expressly of it in the eighth article.

"All my observations shew how much I am convinced of the importance of bringing the earth to a fine loose state: nor can I recommend it too strongly. I have sensibly experienced the good effects of it in all my lands, and particularly in those of the ninth and tenth experiments; for though these fields are but of an indifferent quality, they have produced plants equal to those of my very best lands.

"After what I have now said, no one will be surpris'd that almost all my first crops were but small, since most of the grounds were sown after a single plowing, which was not sufficient to prepare them properly. I was indeed well apprised of this defect at my first setting out: but all I then aimed at was, to lay all my fields into beds as soon as possible; being thoroughly satisfied that it would not be long after, before I should be able to bring them to a proper tilth, with great ease and little cost.

"These three experiments, not only shew us how to conduct our works more profitably hereafter; but they likewise discover a new ad-

advantage in this husbandry, which indeed I suspected from my very first experiments. It is of importance to take notice of it here.

"All the experiments that have been made by different persons, and in different places, have shown us, that wheat cultivated in the new way is very little apt to lodge; that the great strength of its stalk supports it; and that it resists the force of the wind much better than the common wheat, the stalks of which almost always give way in stormy weather.

"It must however be owned, that the wheat of the new culture is not absolutely able to resist extremely violent winds accompanied with great rain. But would any one have expected that the accident I am going to speak of, far from hurting the wheat, seemed to me to be of great service to it, particularly in very rainy years, or when cold dews fall towards the time of its ripening? I observed, in the account of my experiments in 1752, that my wheat was not lodged; but that some of it was bent, without suffering any damage thereby. I added, that I imagined it might be of service to the wheat not to remain always in an exactly perpendicular situation. I purposed watching closely what effect the situation of this would have. I could not be satisfied in this in 1753; but the year 1754 furnished me with observations, and afforded me advantages with respect to the quality of wheat, which it is always of very great service to know.

"Wheat grows up and shoots almost perpendicularly: it does not alter this direction, unless it meets with some obstacle: the most formidable is a violent wind, accompanied with great and heavy rains which lodge it. Every one knows, that when wheat is lodged soon after it has done blossoming, it yields scarce any grain, and that what it does yield is very small and shrivelled, and contains very little flour: a manifest, and oftentimes very considerable loss.

"The wheat that is only bent, continues to grow in that situation: its ears swell and fill equally with grain to the very point, abounding plentifully with good and very nourishing flour. Thus no loss is sustained in this case; and this inclined situation of the stalk does not at all interrupt the functions of the nutritive juices, as in wheat that is lodged. The growth of the plants in this situation, proves plainly that their vegetation is not stopt.

"This bending of the stalks no way hinders a skilful and careful husbandman from giving another plowing, if it be necessary. I had

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it done in the field of the eighth experiment, without hurting or destroying a single ear.

"The three fields on which the experiments mentioned in this article were made, have all their beds in the same direction, viz. from East to West, and lie somewhat sloping toward the West. Soon after the wheat had done blossoming, a strong south wind blew for some hours, accompanied with a heavy rain, which made all the wheat of these three fields incline towards the north. It remained in this situation till harvest, and the stalks grew so crooked that the points of the ears turned down towards the ground: they remained thus suspended, by the strength of the stalks, which seemed even to increase: for I did not find that they bent any more, though the weight of the ear increased as the grain grew riper.

"In this situation, this wheat continued to prosper: the ears filled with grain to the very point: they grew as large and heavy as those of the other fields; and had besides the advantage of being of a finer colour. This quality helps corn to sell sooner and more easily, because the buyer judges by his sight more than by his other senses. It is of consequence in all sorts of goods, to catch the eye; but there is no fear of its deceiving one in the choice of wheat: the good colour of the grain is always a sure sign of its soundness, and invites the purchaser to buy it with confidence.

"Since then there is no fear that any damage will arise from wheat's being bent, there is no cause to repine or be uneasy at seeing it in that situation. But, besides what I have been saying, I must now offer some reasons why I think it may perhaps be better for wheat to be bent and curved in that manner, than for it to grow almost quite upright.

"Let us consider what effect rain, the moisture of the air, and dews have upon the ears of corn in both these situations. When the ears stand upright, and almost perpendicular, they retain a great deal of wet in rainy and dewy weather. This wet insinuates itself very easily between the husks that cover the grain, and gets even into the inside of them. This water, thus got within them, remains there, and does not evaporate so easily as that which is only on the outer surface of the husks, which the motion of the air, or the sun, dissipates in a short time.

"It may happen too, but I shall not give it as a fact which I have yet sufficiently observed, that the water which has penetrated between the husks, touches immediately the grain itself. Now this moisture

moisture all around it, in whatever manner it gets there, must surely be very prejudicial to the grain; and the longer it stays there, the more hurt it must do. We have seen such continual rains in some years, that, for several days together, even the outside of the ears could not be wiped dry, but they have remained wet so long that the corn has sprouted while it stood upon the ground. But, without supposing the mischief to be always so great; wet, by remaining too long upon the grain, may, in some measure, rust it a little, as it rusts straw while standing. I have seen this happen; though indeed but seldom.

"The imperfection that is often found in the quality of the grain, and its sometimes less pleasing taste, may, with great probability, be imputed to this cause: and perhaps it may be found upon stricter inquiries than those I have hitherto been able to make, that the moisture too long retained round the grain, towards the latter end of its growth, and particularly that of cold dews, is the real cause of the fatal and sudden changes which often befall wheat in grain, a little before harvest, and rob us of the best part of a crop which was just before thought to be quite out of danger.

"When the wheat is inclined, its stalks bent downwards arch-wise, and the point of the ears turned towards the ground, it is plain that no wet, either of rain or dews, can so easily get at the grain, and that only the outer surface of the husks will be immediately touched by it: the water, not being able in this situation to glide in between the interstices of the husks, will drip down from one husk to another till it comes to the point, and then fall to the ground. These husks are soon dried again; and the ears which grow in this manner are much less exposed to the consequences of the wet, than those which remain in a perpendicular situation; and consequently their grain ought to be better conditioned.

"This advantage can be enjoyed only in the new husbandry: for in the old way, the wheat is either lodged quite flat, or stands quite upright: scarce any of its stalks are strong enough to support the small weight of the ear, when bent and inclined towards the earth.

ARTICLE IV.

Experiments made on lands laid out in beds, which have borne a first and second crop, together with some interesting observations.

EXPERIMENT, No. XI.

"IN the journal of 1753, (p. 171.) I gave an account of the experiments which a person had made on about twenty-eight acres, laid out in beds of about six feet wide, and which did not meet with the desired success. I added, that the same person, persuaded nevertheless of the advantages of this culture, had prepared twenty-five acres more in the same manner, and that all of them were sowed for the crop of 1754.

All this ground was plowed with care, and part of it was sowed earlier than the year before. Some little addition was likewise made to the quantity of the seed. The plants in general rose extremely well, and were strong and healthy before winter, in proportion to the time of their being sown, and to the quality and condition of the land.

Such a beginning gave room to hope, that these fields would yield a pretty good crop; but the winter ruined all; and scarce any thing was reaped from so large an extent of ground.

OBSERVATIONS ON THIS EXPERIMENT.

"I T would be unfair in me not to mention this experiment, tho' it answered so badly. The reader may be surprized at first, to see so great a contrast between this and my own experiments, in which, notwithstanding the intemperature of the seasons, and other accidents, he finds the crops increase, as the land becomes better tilled according to the principles of the new husbandry. This increase was what we foretold would happen: but the field we are now speaking of, produced less the second year than it did the first, tho' even that was very little.

"There must then necessarily have been some differences between these fields, to which this great disparity of their crops was owing. These differences doubtless were, either in the quality of the soils, the preparation of them, their exposition, the quantity of the seed,

the accidents that beset them, which might be greater or less, in some than in others, or, in short, many other causes capable of helping or hurting the crop: for otherwise, supposing all these things to be equal, or nearly so, the difference in the crops could not have been great.

"Not to impute the bad success of this last experiment too lightly to the new husbandry, we ought, in justice, to examine whether it might not be owing to some other cause, and whether there may not be room to hope for better success another time.

"These fields without being all exactly of the same quality, are generally reputed in the country *cold and stiff lands and very apt to grow hard*. Such lands will certainly require more time, more patience and more perseverance, to bring them to any degree of tilth: more plowings will be necessary, and those plowings must be given in the most proper seasons. By continuing to stir them well, their hardness and resistance will be overcome, their pores will be opened and multiplied, and plants will then thrive in them as well as in the best of soils.

"All lands ought to be treated according to their respective qualities. There is great reason to believe that this field, when prepared as those of the experiments No. VIII. IX and X. were, will hereafter produce great plenty of corn. What I now say, is not mere supposition or surmise. Repeated experiments, the effects of which have constantly been the same, have taught me, and I can safely affirm, that extremely bad lands, which could not so much as yield a crop that would pay the expence of tilling them, have been rendered good and fertile merely by plowing, and without the assistance of any manure.

"This is a striking truth. It was what first determined me to practise the new husbandry, and therefore it was of consequence to me to be certain of it. To this end, I resolved to make a trial on a small spot of ground, which I knew to be incapable of producing any thing.

"Some years before, I had dug away the earth three feet deep, from a space of 60 square toises: nothing remained in it but a close white clay, fit for potters use. This spot, thus circumstanced, seemed to me a proper one for my experiment. As the space was too small for the plough to work in, I made use of the spade and hoe. It was made into beds, which were afterwards sowed with wheat, and the spaces between them frequently stirred. The first year, my

plants were very poor, and branched into only two, three, or four stalks a-piece. The second year, they did much better; and the third year, they were as large and fine as any my garden could have produced. This spot still continues to produce equally well.

"We have here a remarkable instance, of what may be done by sufficiently pulverising the earth; that which I am speaking of, is now like mould; and, which is very remarkable, it has lost its former white colour, and is become black. Let us now do the same with any of our bad lands, and persevere in plowing and stirring them a sufficient time: the success will not be doubtful.

"But to return to the subject of this article. Some of the fields we were speaking of, are surrounded by, or border upon woods. This situation is far from being good, and it seldom happens but that such a neighbourhood does great injury to the crops.

"I could likewise have wished, that a larger quantity of seed had been employed to sow these fields. The loss occasioned by the frost might have been lessened thereby; as it may be presumed that a greater number of plants would have escaped, if they had been thicker in the places where all of them were not entirely destroyed.

"We observed before, that the young plants were in a fine condition before winter, and that they promised well; but the severity of the frosts, doubtless too great for the condition and situation of these lands, did an irreparable injury to almost all these fields.

"I examined the greatest part of them in the beginning of spring. Of all those which I saw, I found but one spot of three or four acres, of which the earth was in the condition it ought to be; that is to say, well stirred and broken, supple, light, and penetrable. Too few plants were left in this good spot: large spaces were quite empty in most of the rows: but those that did resist, grew very fine in the summer, branched extremely well, and bore fine ears.

"By this one might guess what these lands were capable of. My opinion is, that, in other years free from such accidents, the rows will remain well stocked with plants, which, finding sufficient nourishment, will be nearly of equal strength and beauty in every part, and, all together, will produce a considerable quantity of corn.

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"The other fields were infinitely worse treated.* Every thing was destroyed for several acres together. The plants were rooted up by the strength of the frost, and lay scattered upon the ground, all along the rows, withered and unable to recover the least vigour: These are the only fields laid out in beds, in which I have seen this extraordinary accident: not a plant was rooted up any where else. It is very difficult not to suspect that there must have been some fault in the sowing, and that the sower did not perhaps bury the seed deep enough. The roots which were too near the surface of the earth, were nipped by the frost. They must have been so, supposing them to be but about two inches deep. We likewise know with certainty, that if the seed had been sowed in good time, the plants would have had roots above six inches long; and that such roots would have secured them from being killed by the frost. There is room therefore to believe that the seed was not buried deep enough.

"But even supposing the plants not to have been destroyed, I doubt whether they would have yielded a good crop; because the ground, especially that of the partitions between the rows, was extremely hard and close, and therefore quite unfit to supply the plants with the nourishment they would have wanted.

"This experiment required these remarks: many more might be added; but these are sufficient to shew that some lands require a double portion of care and labour.

EXPERIMENT, No. XII.

"THE account of the ninth experiment in 1753, (p. 172.) promised better success the next year. The whole culture was performed by the same person, with great care and extraordinary judgment on two fields, containing about ten acres. One of these fields is much better than the other: the beds were about six feet wide: one half of the field, the soil of which was inferior to that of the other, was dunged; but not above a third part as much as it would have been in the common way. The soil of this field is very stiff. It

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* All these observations, says M. du Duhamel, shew that this land is of the nature of those which swell greatly in hard frosts, and, subsiding again upon a thaw, leave the roots of plants quite bare upon their surface. In whatever manner they are cultivated, they seldom produce any thing if the winter is severe. The best way is to sow them with spring corn.

had not been plowed for 15 or 20 years, and was not yet sufficiently loosened and divided.

It was sowed early: the plants rose very well, but were greatly hurt by the frost, excepting those which the dung preserved. The same thing happened to the beds which were sowed with six rows.

The soil of the other field is fatter and of a better quality. The winter did it little hurt. The plants thrive by the culture that was given them, but less than was expected; owing, as is supposed, to the great drought of the season. These two fields produced, however, about 7000 pounds weight of wheat; which is extremely well, especially for a first crop.

These two fields have given us room to make two reflections. First, that *the earth must be well prepared, without which the plants are not able to extend their roots to the plowed part of the alleys.* Secondly, that, in dry springs, the plants of wheat preserve one another mutually from the drought, for which reason it is proper to sow somewhat more than would otherwise be necessary.

The same culture is now practised for the year 1755, and is extended to about fifteen acres more.

EXPERIMENT. No. XIII.

I Mention this experiment on account of the faults the husbandman committed, that others may take care to avoid them. Near three acres of pretty well plowed land made into beds, produced only about 780 pounds of wheat the second year.

The reasons why this crop was so scanty, are evident. In the first place, too little seed was sowed: there ought to have been three times the quantity. Secondly, the beds were of an excessive breadth, all of them being eight or nine feet wide, and sowed with only three rows. By this means, great part of the ground was lost; which ought to be carefully avoided.

The plowings too were made in a very slovenly manner: the husbandman gave them, not when they were necessary, but when it suited his convenience. The reason was, that he was prejudiced against the new husbandry, and did not desire to see it succeed.

ARTICLE

ARTICLE V.

Experiments made by several Lovers of Agriculture, on lands sown in equally distant rows with the drill-plough.

"SOME of the principles of the new husbandry have been adopted in this way of sowing; and even the common plowing is now performed with more care than it was before the great advantage of thoroughly dividing and breaking the earth was so well known. This method of sowing the land all over in equally distant rows, being, in appearance, easier and more simple than forming it into beds, has now a great number of partisans: and, indeed, the grounds which have been sown in that manner, have yielded much better crops than the fields cultivated in the old way.

EXPERIMENT. No. XIV.

"IT is pretty generally the custom about Geneva, if the land is good, to sow it in April, over the wheat, with clover seed, which yields a crop the next year. Agreeable to this custom, a field of about three acres, was sowed with clover in April 1752. In 1753 it yielded two crops of clover, after which the owner of the ground gave it three good plowings in the common way. The clods which the plough had left, were afterwards broken by hand before the field was sowed; for it was resolved to spare no pains to give it a good preparation.

"About 630 pounds of wheat used generally to be employed to sow this field: but it was now sowed, on the fourteenth of September, with only 315 pounds. The earth was extremely dry, and the weather very hot, which it continued to be for ten days longer, circumstances which ought to be attended to, and which it will be proper the reader should remember when he comes to the continuation of this experiment in the seventh article.

"This field was plentifully stocked with plants. They yielded 2926 pounds of wheat. In proportion to the produce of the other fields of the same farm, this would have yielded, at most, only between 18 and 1900 pounds: consequently here is a gain of about 1026 pounds, besides 315 pounds saved in the seed, which makes in all a profit of 1341 pounds.

EXPERIMENT. No. XV.

"THE same person who made the experiments, No. VII, in 1752 (p. 153.) and No. X. (p. 173.) and XI. in 1753, (p. 174.) continued them in comparison with the old husbandry. They answered as before, and the same advantages were again confirmed. A detail of the particulars would be needless. I shall only add, that barley, with which the experiment was likewise tried, answered much beyond any thing that was expected, and yielded a prodigious crop.

"The farmer, convinced by such success, of the superiority of the new husbandry over the old, immediately begged his landlord to make no more experiments by way of comparison, but to let him sow all his lands with the drill-plough.

EXPERIMENT. No. XVI.

"THIS experiment was made in the same farm where the XIIIth and XIVth (p. 175.) were made in 1753. All the lands were very well prepared, and sowed with the drill-plough.

"One of these fields, which contained about four acres, and used to require 850 pounds of seed, was now sowed with 315 pounds. The plants were extremely fine, both before and after winter, and, when reaped, yielded 4940 pounds of wheat. If it had been sowed in the common way, it could not have been expected to yield above 2900 or 3000 pounds: consequently it now produced 1940 pounds more; to which if we add 565 saved in the seed, we shall have 2505 pounds of wheat more by the new, than would have been obtained by the old husbandry.

"Another field of an inferior quality, the extent of which is near nine acres, used in the old way to be sowed with 1764 pounds of wheat, and was now sowed with only 819 pounds, which produced about 5720 pounds. Though the difference in the goodness of the lands is considerable, yet the drill-plough still maintains its superiority: for, if this field had been sowed in the common way, it would have been thought to have produced an exceeding good crop, if it had yielded between 5200 and 5300 pounds, though that would have been 420 pounds less than this, which added to the 935 pounds saved in the seed, make this crop 1355 pounds greater than it would have been in the old way.

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"A small spot, of about an acre and a quarter, which used commonly to be sowed with 157 pounds of wheat, was sowed with 63 pounds, and produced 430 pounds. This is nearly the same proportion as the foregoing experiment.

"These fields, being some better than others, may serve to shew what may be expected from lands of different qualities.

"A piece of ground of thirty acres was likewise plowed with care. This, to have sowed it in the old way, would have required about 6550 pounds of seed, which would have yielded at most 20000 weight. I even think I over-rate it in this.

"These 30 acres were sowed with 2772 pounds of wheat. Here is, in the first place, a saving of 3778 pounds in the seed, which is a very considerable object. The whole crop yielded about 19000 pounds, which added to the 3778 pounds saved in the seed, make 22778 pounds. The profit therefore is 2278 pounds more in the new way than in the old.

"To set this experiment in a yet clearer light, I shall add, that the sheaves were strong, the straw fine, the grain very clean and plump, and that half these fields had suffered considerably by the frosts in March.

"The produce of a few detached pieces of land, might not have been sufficient to persuade the generality of mankind, so much as to adopt even this change, which consists solely in the manner of sowing the land. They might still think it imprudent to give up a certain profit for an uncertain one. It is fit therefore that they should see by the management of a whole farm, that this husbandry may be practised to a very great advantage. This we shall shew in the following article.

EXPERIMENT. No. XVII.

"THIS experiment, which is a very considerable one, was executed on the same person's lands, who made the experiment No. 12 in 1753, (p. 174.) All the lands were sowed with the drill-plough. They were plowed four times, and a small part of the whole was dunged. I cannot enter into all the details of this operation; but the general results, which we shall give, will be sufficient.

"The lands we are speaking of compose three farms, situated in three different villages, about a mile and a half distant from each other. These lands are of different qualities; some stiff, others pretty light, others of a middling quality, and but little stony.

About

About 120 acres were cultivated in the first farm, 40 in the second, and 40 likewise in the third. In all 180 acres.

		Pounds.	
The quantity of seed used in the common way, was,	For the first farm, sowed in August and September	21420	} of wheat.
	For the second farm, sowed between the 1st and 15th of October	8190	
	For the third farm, sowed between the 20th and 30th of October	8190	
	In all	37800	

		Pounds.	
The quantity of seed sowed with the drill-plough, was,	For the first farm	8190	} of wheat.
	For the second farm	3276	
	For the third farm	3276	
In all		14742	
Saved in the seed		23058	
Total		37800	

		Pounds	
Crops in 1754.	First farm	70200	} of wheat.
	Second farm	22750	
	Third farm	15210	
Total crop		108160	
To which must be added the saving in the seed		23058	
The whole profit is		lb. 131218	of wheat.

It

"It will be right to see now what the same extent of land might possibly have produced, if it had been cultivated in the old way. This can indeed only be guessed at, and I chuse therein to favour the old husbandry. According to the general run of this year's crops, these three farms would have produced at most about 95000 or 100000 pounds of wheat; which would consequently have been 31218 pounds short of what they yielded in the new husbandry.

"This way of stating the account of the produce of both methods, is a fair one. *The saving in the seed is always to be reckoned.* But I have perceived, by the questions which several persons have asked me with regard to accounts thus stated, that they were not rightly understood. I shall therefore throw them into another form, which has been thought clearer, but of which the results will still be the same.

"We will reckon only the real and actual produce, and then subtract the seed: the remainder will consequently be the neat produce.

NEW METHOD.

Total produce	108160 lb.
To be deducted for the seed	14742 lb.
Neat produce	<u>93418 lb.</u>

OLD METHOD.

Total produce	100000 lb.
To be deducted for the seed	37800 lb.
Neat produce	<u>62200 lb.</u>

"Therefore the new method produced more than the old would have done. } 31218 lb.

Proof 93418 lb.

"Which result is the same as that of the other comparifon.

"Are not such advantages well worthy the attention of every one concerned in husbandry ?

EXPERIMENT. No. XVIII.

"WE saw by the 15th experiment in 1753, (p. 176.) that the fields which I had sowed, with the drill-plough, in equally distant rows, yielded very little corn. I mentioned the causes, which I knew. I have not yet had time to form them into beds, by which means I shall certainly remedy the cohesion of the soil, and without which those lands will never yield any other than poor crops, as they have almost always done whilst cultivated in the old way, which is infinitely less fit for lands that require a great deal of stirring, than for such as are naturally fruitful.

"I hope I shall be able to begin next year to practise the new husbandry in this farm. I should have done it before now, if I could have made any stay there: but as I could not, I have only continued to sow it with the drill plough in equally distant rows.

"I shall mention another small farm, on which no dung or any other kind of manure was used, though its lands, at least the greatest part of them, are but very indifferent.

"I sowed these lands towards the end of August and the beginning of September, in pretty hot and dry weather. The whole extent of this little farm is between 22 and 23 acres, which used to take up 4662 pounds of seed: but only 1950 pounds were employed now.

"Some places looked well enough: but in general the wheat came up thin. I was however very well satisfied with my crop, which yielded about 13000 pounds of extreme fine wheat, so clean that it wanted no sifting. If I had not sowed with the drill-plough, I should scarcely have reaped more than barely the seed: for that was the case with all my neighbours, who had only about their seed and half as much over; and many of their crops yielded still less. It is not to be supposed that I should have fared better than them, if I had followed the old way, as they did.

ARTICLE VI.

Summary accounts of the products of several pieces of land sowed in equally distant rows with the drill-plough.

EXPERIMENT, No. XIX.

"AS nothing but a great number of experiments, repeated under different circumstances and in different places, can convince some people of the advantages of the new husbandry; I am the more readily induced to mention all that have come to my knowledge; though there are among them several of which I have not been able to get so particular a detail as I could have wished: all that has been told me in relation to many of them being, that those who made them were well satisfied with the crops they had obtained by means of the drill-plough, and that they intended to continue using it. But the following experiments will merit the reader's attention.

"The lands I am going to speak of, lye in a space of about 30 square miles; and there are great differences in their qualities and situations: they were not all plowed with equal care: some of them were dunged, and others were not; and lastly, the drought was greater at some villages than at others. Notwithstanding all these diversities, it will appear from what we are going to say, that the use of the drill-plough was attended with uncommon success every where.

"To shorten, and at the same time give the reader a full view of the purport of this article, I have drawn up a table of the extent of the several pieces of land, the quantity of seed used for sowing them in the old way, the quantity they were sowed with in the new husbandry, and their produce in this last culture. Though these experiments are not related so exactly as my own, I am sure there is no mistake of any consequence in them.

I should have been very glad to have known likewise the exact products of the crops in the old way. I have done all I could to come at the knowledge of them, but have obtained only very few satisfactory accounts. All that I have been able to learn, amounts only to a confirmation of what I found in my accounts of the culture and produce of my own estate; for an exact account thereof has been kept for about forty years past. Beyond that time, my

papers furnish me with only the product of now and then a year, but not of any number of years together. These detached hints have however afforded me some curious and useful knowledge. For example, I have learnt by them, that the product of land was the same in the last age as it is in this. In the year 1668, which is the farthest back that any of my papers take notice of, I find the crops were like those which the same lands have yielded for these last 30 or 40 years.

" All my enquiries have shewn me that, in this country, in what are reckoned good years, the lands yield but three times the seed; seldom more, and often less. Some few fields indeed must be excepted, which, being of a very extraordinary goodness, do produce more; and likewise, on the other hand, some very bad lands which do not yield so much: so that, upon the whole, this may be reckoned the medium crop during any number of years.

" The neat produce does not by any means amount to the whole of the crop, in the common husbandry: for the good grain is frequently so mixed with bad, and with the seeds of weeds, that it suffers a considerable diminution thereby. The quantity of perfect grain is therefore what ought to be considered; and in this many are apt to deceive themselves. Whenever people become sensible of the small advantage of the common husbandry, they will be more ready to attend to what is said in favour of the new, and will be inclined to verify it by their own experience. When so convinced, they will endeavour to overcome the dislike which most farmers have to this new method. They are, in general, a set of men, fit only to execute what they are bid to do; and therefore ought to be directed by persons of better understanding. Patience and perseverance may by degrees induce them to practise the new husbandry, which time will bring to its greatest perfection.

" The following table will help to strengthen these reflections.

TABLE

T A B L E.

Of the Extent, Sowing, and Crops of different Pieces of Lands, in the year 1754.

Extent.	Quantity of Seed in the old way.	Quantity of Seed in the new way.	Crops.
Acres.	Pounds.	Pounds.	Pounds.
2	336	168	1560
2	356	180	1230
4	882	392	2360
1	252	130	650
4	882	346	2275
3	672	283	2080
9	2016	670	6110
5	1008	485	4680
1	190	95	1040
2	504	230	2520
4	819	390	3120
1	315	140	975
2	694	300	2340
Total 44	8926	3809	30940

ARTICLE VII.

General Reflections and Observations on the Experiments contained in the foregoing Articles.

AFTER all these experiments, I ask myself, whether they are sufficient to give us a satisfactory demonstration that the new husbandry is more profitable than the old? I answer, without hesitation, that it certainly is more profitable, both to the public, and to each individual, whether the lands be cultivated in beds, or whether they are only sowed in equally distant rows, with the drill-plough.

Such will likewise be the answer to this question, if the result of these different experiments be considered. In the first place, we have

have those of each field in particular; in the next, we have those of some whole farms; and lastly, we have those contained in the table of the sixth article, to which last I shall now limit my reflections.

"We may look upon the produce of 44 acres spread up and down an extent of thirty square miles, amounting all together to 30940 pounds of wheat, as the medium produce of the generality of our lands. I shall therefore not dwell upon the produce of each of these fields taken separately, but only consider now, that 44 acres yielded 30940 pounds of wheat.

"If these 44 acres had been cultivated in the old way, they certainly would not have produced so much; since we have seen that the medium produce is but three times the seed: and I am satisfied it would have been less this year 1754. However, I will suppose the crop to have yielded three times the quantity of the seed. These 44 acres, sowed with 8926 pounds of wheat, would then have produced 26778 pounds; deducting from which 8926 pounds for the seed, the neat produce will be reduced to 17852 pounds.

"The 44 acres sowed with the drill-plough yielded 30940 pounds; from which we are to deduct 3809 pounds, which was all the seed that was sowed. The neat produce will then be reduced to 27131 pounds, which is 9279 pounds more than would have been produced in the old way.

"The owners or farmers of these 44 acres had therefore 9279 pounds of corn more. They reaped the first benefit of this gain, and the public the next, as so much more corn was carried to market, than would otherwise have been. Such an advantage is very considerable, and deserves the utmost attention of the public, whom we invite to consider it in a more extensive light. The object will thereby become the more interesting.

"Let us but consider how much greater a quantity of corn this space of nine or ten square leagues would have produced, if all the arable lands in it had been sowed with the drill-plough: how much more grain would it not have afforded for the nourishment of the people! what increase of income to every individual concerned therein! and how sure a way to guard against future dearths!

"But this is not yet all. Much greater advantages will still result from the cultivating of lands entirely in the new way: I mean, by laying them out in beds, and observing all the practices of the new husbandry. This I proved plainly in my journal of 1753, by the calcu-

calculations of the articles II, V, and VI. This demonstration is fully confirmed by the experiments of 1754, the products of which were greater, and their results still more favourable to the new method.

“What has been already said on this important subject, shews, what the necessary operations are, how easily they may be performed, and what are the points which merit most attention. The theory of the new husbandry is now fully proved by experiments; and that great principle, the necessity of preparing the earth well by proper stirrings, so clearly demonstrated, that it would be needless to insist any longer on it.

But the sowing of the land, which is of the utmost importance to the success of the crops, depends greatly on the time and season when it is performed, and the care with which it is done. We shall therefore give some observations on that head.

“The three most essential things which constitute a good sowing, seem to me to be, next to the proper preparation of the earth, first, the time of sowing; secondly, the choice of the seed; and thirdly, the due temperature of the season, with respect to heat or cold, drought, or wet; all which greatly influence the state of the earth.

“With regard to the time of sowing, I say, it is better to sow early, than too late, provided the season will admit of it. The plants are better able to resist the severity of the winter, after they have acquired a certain degree of strength. There have been years in which fields sowed very late, for instance in December, have done extremely well: but that ought not to be made a general rule: experience shewing that such late sowings very seldom answer.

“By too early sowing, the corn is equally exposed to other dangers. The stalks which shoot up before winter, cannot well bear hard frosts, which would do no hurt to the wheat when but in blades. I observed, in the two last years, 1753 and 1754, that the first sown wheat, which was attacked by the *rust* in autumn, was much more hurt by it than any other. Therefore, I think the best time for sowing, in such a climate as Geneva, is, from the 20th of August, to the end of September. If, however, it should not be practicable to sow all the lands within that time, the first fortnight in October may likewise be taken in: but this I would not advise, except in a case of necessity. If all the land should not be sown within that time, I think one might expect a better crop by deferring to sow

till

till spring. What I have been saying is more particularly applicable to lands laid out in beds.

"The same rules by which I judge of the proper time of sowing here, may easily be adapted to other climates, in some of which the land will require being sowed earlier, and in others later.

"The choice of the seed is the second thing, which to me seems to require more particular care than many may perhaps imagine. Every one certainly endeavours to chuse the best wheat he can for seed: and it ought likewise to be very clean. Such corn is not difficult to be had, when reaped off the beds cultivated in our way.

"Tho' wheat so green that it had scarce lost its milky quality, sprouted pretty well when I tried the experiment with it; I think it is more proper to sow none but what is thoroughly ripe. The seed has then attained its full perfection; and it is from that ripeness that we may most certainly expect the most vigorous plants.

"The wheat that has been reaped in a warm dry year, seems to me fitter for sowing, than that which has been gathered in a cold wet year; for in such a season, all the productions of the earth are less good; their taste is less savoury; and as that wheat in particular in which there is most moisture, is most difficult to keep, I infer from thence that the formation of its grain must be less perfect. I should therefore prefer wheat a year old; provided the year it was gathered in was warm and dry, to that which may have just been gathered in too rainy a season. Accordingly, I always chuse for sowing, wheat of the growth of my high lands, rather than that which has been produced in flats.

"The benefit accruing from all this care, may, perhaps, not be extremely great; but at the same time it costs nothing. Let us do in agriculture what is done in all manufactures: the very smallest profits, the very least savings, are never neglected. Those small articles, often repeated, make large sums in the long run, and are a real profit.

"There is another thing of greater consequence, and of which I strongly recommend the practice. It will not be attended with any expence. It is by repeated experiments, always attended with the same success, that I have found it to be extremely serviceable

* Repeated experience has taught us, that the same rule may be observed in this kingdom. Perhaps the colder the climate is, the earlier the wheat should be sowed, that it may acquire the greater strength to resist the winter's cold, and shoot its roots so deep into the earth, that it may not be thrown out by the frost.

able to the first sprouting of the seed. Chance first made it known to me.

"I have often sowed, purely to try what wheat was fittest for sowing. I commonly sowed wheat taken from the heap in the granary. I likewise frequently sowed wheat picked out of the ears the moment before I sowed it. I counted the grains of both sorts exactly. Would any one think there could be any difference in the productions of these grains? yet I found a considerable one: what was picked out of the ears, always rose extremely well; scarce a grain of it ever missed; whereas numbers of those which were taken from the heap, never sprouted at all. I did not perceive this difference at first; but at last it struck me. I relate the fact as it is, without pretending to account for the cause of this difference, which would lead me into too long a digression. The experiment itself may be of real use. It shews us, that instead of threshing the wheat intended for seed at any time, without distinction, it ought not to be threshed till a very few days, at most two or three, before it is sowed. A few hands will be able to supply the sowers with as much as they will want. This will not be attended with any sort of expence, and may be the means of saving somewhat in the seed.

"Perhaps too, this practice may be attended with a very valuable advantage. I have not indeed yet made the trials necessary to satisfy me of the reality of what I imagine: but my desire to be of service to the public, induces me to mention it, that the lovers of agriculture may reflect upon it, and try such experiments as will clear up my conjectures.

"Threshing the seed only just before it is sowed, may possibly, in some measure, or perhaps entirely prevent the first cause of the distemper which we call *charbon**. By this I mean, that the seed which has not been mixed with smutty wheat, or any way infected by its black powder, will be exempt from that distemper. Not that I take that black powder to be absolutely the original cause of this distemper: but I believe it very capable of communicating it to grains that are sound.

"I wish the multiplicity of my occupations may permit me to endeavour to clear up this matter, and pursue the observations I have begun to make. If I can be so happy as to make any useful discoveries, I shall communicate them to the public.

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* A kind of *smut*, for which see p. 93.

That nothing may be neglected which can be of any service to the seed, great care ought, in my opinion, to be taken in threshing it; especially in the manner that is commonly practised, with flails, upon the barn floor, or by trampling it with horses. In either of these ways, a great number of the grains are so bruised and hurt, that it is impossible they should ever grow. If the wheat intended for seed, is not thoroughly dry and hard, the mischief is still greater; much more of it being then absolutely crushed by the flail.

As the new husbandry requires much less seed, it will be the easier to execute an operation which might be too long and troublesome to practise for so great a quantity as is used in the old way.

The method I advise, and which I myself have practised, is this. Let one or two beams, two feet and a half, or three fit thick, be laid across the barn floor: let the threshers stand at each side of the beam, with a loose sheaf of wheat behind every man, from which he will take a handful at a time, and give it two or three strokes against the beam: this will bring out a great deal of grain, which is to be reserved for seed. These ears may be bundled up again, and afterwards threshed out with the flail, for other uses.

This method is not so tedious as some may imagine: we are sure that not a grain is bruised; the corns drop very readily out of the ears, especially of wheat that has grown in beds: the great size of the grain helps to open the husks, and those are the most perfect grains which drop out thus. I think I may compare this operation with what is done in the making of wine. The first running is always the highest flavour'd and best.

Though the proper time for sowing be come, the corn ought not to be put into the earth, if the temperature of the season is not favourable. It ought, on the contrary, to be deferred, in hopes of a change. If the weather is very hot, and the earth extremely dry, there will be an absolute necessity of waiting till some rain has fallen. Without this precaution, the seed will rise but very imperfectly. I am sure of it, by several experiments which I have made, and which contradict a common saying of our farmers, that the earth is the best granary to keep corn. Full of this notion, whenever the stated time comes round, they sow without distinction, in wet or dry land: even heat does not hinder them: they think their seed will certainly sprout well after the first rain: but I have always experienced that the plants have come up thin.

I tried an experiment purposely to satisfy myself whether one
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can sow with success, when the weather is very hot, and the earth very dry. Upon reading Mr. Duhamel du Monceau's excellent treatise on the preservation of corn, I observed that he had found by his experiments, that wheat which had been dried in a stove heated to 60 degrees of M. de Reaumur's thermometer, had lost its faculty of growing.

"From thence I conjectured that wheat which should undergo a heat, for example, of 30 degrees, during a longer time, would be equally parched up, and rendered incapable of vegetating. I considered the earth, when hot and dry, as a kind of stove, in which if the seed remained too long, without receiving any moisture, it may become so dry, that the greatest part of it will never be able to sprout. I thought this reasoning just; and therefore determined, in order fully to satisfy myself, to have recourse to that trusty guide, experience.

"On the 18th of July, 1754, at four o'clock in the afternoon, I placed M. de Reaumur's thermometer two inches deep in the earth, and screened it from the immediate impression of the rays of the sun. The liquor rose to the 31st degree, which shewed me the heat of the earth.

"The thermometer being afterwards exposed to the sun, the liquor rose to 56 degrees.

"The same day, I sowed 80 grains of wheat in the same ground. The heat continued nearly the same the rest of that month, and almost all August. On the 31st of July, only 10 grains had shot up, and on the 16th of August there were in all 16; after which, not one more rose: consequently 64 grains out of the 80 never sprouted at all.

On the 28th of July I sowed 50 grains. Only four of them rose by the 16th of August, and not one after. Here were again 46 grains which did not grow at all.

The same day, I sowed 60 grains in another place. On the 16th of August only six grains had sprouted, and not one plant more ever appeared after: consequently here too were 54 grains which never grew. All these grains were sowed in my garden, in exceeding good mould.

"I was sure that the wheat I sowed was perfectly sound, and in every respect capable of growing. It was therefore quite clear, that so great a number of grains out of the whole, which did not sprout at

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all,

* Wheat has however been known to rise very well after having remained six weeks or two months in the earth: perhaps the circumstances were different.

all, had lost the faculty of growing, by their being parched up by the heat and dryness of the earth. To be still more certain of this, three weeks after I had sowed these grains, I watered half of them several times; but to no purpose: not one of them rose, and I found several of them quite whole in the earth where I had sowed them.

"After this experiment, on the 11th of August, I suspended the sowings I had begun the 8th, and did not resume them till the 26th, after some rain which fell on the 22d and 23d. These last sowings rose much better than the first.

"Thus it is that experience and observation teach us to leave off bad customs, or such as are not founded on principles with which a man of sense can rest satisfied.

"Whenever the produce of the fields on which my experiments were tried, is considered; it ought always to be remembered, that I used no dung on any of those lands, and that they received no other improvement than what was owing to a better preparation of the earth, only by stirring it. Those who chuse to have recourse to dung, will probably reap greater crops: with an hundred loads, they may dung three times more land than is done in the common way; for the dung should be spread very thin, if one would have it be of any service. By spreading it too thick, I believe the plants would grow too rank, and be apt to be lodged.

"The new husbandry supplies the want of dung, not only by stirring the earth, and not over-burdening it with too many plants, but likewise by the strong thick stubble it produces, which affords a most excellent manure, attended with no expence. It lies ready upon the spot; the plowing of the earth buries it; and as it is a long time in rotting, it helps to keep the soil loose and light, and is repeated every year. I have found stubble almost whole at a year's end; and some I have seen not quite consumed at the end of two years.

"But can we be sure that this manure is of any consequence, or real advantage? After what I have already seen of its effects, I will venture to say, that it contributes greatly to increase the productions of the earth. I have very often plucked up plants remarkable for their beauty, and have frequently found their roots interwoven with tufts of stubble, which shewed me the cause of their extraordinary growth. I shall soon have more positive proofs of this, by the experiments I am now making to clear up this point."

ARTICLE VIII.

Experiments made on beds sowed with six rows of wheat: comparison of their produce, with that of beds sowed with only three rows; and some inquiry concerning the number of rows which it is best to sow.

"IN the journal of 1753, article VII. (p. 181.) I gave an account of my success in sowing beds with two turns of the drill-plough, in order to have six rows of wheat. It answered so well, that I thought I should run no hazard in sowing a larger extent of ground in the same manner.

"This experiment succeeded equally well this year. I shall not enter into a detail of it, because that would be only a repetition of what I said on this subject in 1753. As to the result; the reader will recollect, that the same ground made into beds wide enough to be sowed with two turns of the drill-plough, which make six rows, produced more corn, than if it had been sown in beds with only one draught of the drill-plough, which would have made but three rows.

"With regard to the quantity of the products of the crops of 1753 and 1754, compared together; I have found, that the six rowed beds produced this year very nearly the same that they did in 1753; excepting the field of the experiment, No. VIII, (p. 171.) which yielded about half as much again as the year before.

"Notwithstanding the profit which I found in these experiments repeated two years running, I do not think it adviseable to enlarge the number of rows to so many as six. Five will, in my opinion, be very sufficient: and they may be made with one cut of the drill-plough, by giving it five shares, which is very easily done. This number of rows will be a proper medium between six and three.

"Sowing in five rows will not, however, do in all sorts of lands. I believe it should be practised on none but good ones, and that middling lands should continue to be sowed with three rows at most.

"I shall add farther with respect to good lands, that they ought not to be sowed with five rows, till after they have been thoroughly well stirred; and, above all, not till after the great furrow in the middle of the beds has been cut extremely deep, in order that the roots of the middle row, which is the most distant from the plowed alleys,

alleys, may find a sufficient depth of mould immediately under them, to supply them with their necessary nourishment.

“ But at the same time that a provision is made for the nourishment of the plants, care must be taken not to lose too much land, by making the alleys wider than they need be. My experiments have determined me to make my beds for the future about six feet wide. By leaving seven inches distance between each row, the five rows will take up about two feet four inches, and there will remain three feet eight inches for the breadth of the alleys. This space is sufficient for the plough or cultivator to operate in with ease.

ARTICLE IX.

Experiment made in order to know which is the most profitable way of sowing the beds; and to ascertain more precisely the quantity of seed proper to be used, in order to have the greatest crop.

“ THE title of this article divides it naturally into two parts, which I shall treat separately.

“ It is of great consequence to know which is the most profitable way of sowing the beds; that is to say, that by which they will be stocked with a proper number of plants; for when too much seed is sowed, the plants hurt one another; and when too little, the earth is not enabled to produce so much as it is capable of doing.

“ The business therefore is, to determine what number of plants would be most advantageous. Luckily, the difference is wide enough between the too great, and the too small number; and the produce of the crop cannot be diminished but by an excess one way or the other.

“ But whatever certainty we may acquire with respect to this interesting point, we cannot flatter ourselves that we shall always be able to keep to it in our practice. The various accidents to which corn is liable, from the hour of its being sowed till it is reaped, will always frustrate the methodical arrangement which we may have intended to give the plants.

“ The difficulty of succeeding in this inquiry, ought not however to discourage us: for it would be attended with such advantages as would make very ample amends for all the labour bestowed upon it. Let us then have recourse to experiments. Those that are made with this view, will never be quite useless. If they do not lead us

to

to the very thing we are in search of, they may at least discover to us others which may be of service.

“According to our principles, the distance between each plant ought to be equal throughout the whole length of the rows, that all of them may have an equal quantity of earth to draw their nourishment from.

“Several experiments have shewn, that six inches is not too great a distance for the plants to be at from one another. In this case, it would be sufficient to sow one grain of wheat from six to six inches. According to this disposition, a field well prepared ought to produce the greatest crop. The plants will very commonly branch out so as to have 20, 30, or 40 stalks: I have had some with upwards of 80. 'Tis pity that this exact distribution of the seed cannot subsist long. The accidents I met with soon convinced me, that it was necessary to increase the quantity of the seed, and that very considerably.

“However, this does not yet hinder me from thinking, that if any easy method could be found, to have a plant of wheat exactly at every six inches distance in the rows, it would be the best way of sowing lands. I have often considered how this could be reduced to practice, as well to satisfy my curiosity, as that I might be the better able to proceed in my operations. When a theory is known to be good, one is strongly encouraged to draw all possible advantages from it for the practical part; one proceeds with confidence and pleasure.

“Experience having convinced me that it never would be possible to have a plant at every six inches in each row, by sowing only a single grain of wheat at those distances; it naturally followed, that the way to have the ground better covered with plants was, to sow more grains. The next question was, how many grains should be sowed in each place: should it be two, three, or more? Experience only could clear this doubt. I therefore tried the following experiment. I sowed a different number of grains *in clusters, six inches distant from each other*, putting one grain in the first, two in the second, and so on to the sixth, which had six grains: then I began again, and went on as before, till the whole length of the row was sowed in this manner. The produce of each cluster was to shew me whether it would be best to double, triple, or quadruple the seed, which it was plain had been sowed too thin, when only a single grain was dropt at every six inches.

“The winter of 1753 was already far advanced when these thoughts first occurred to me. It was then too late to try this experiment with

with wheat: but, that I might not lose a year, I did it in the spring with barley; not doubting but that corn, which is usually sowed in March, might furnish me with some future hints for the culture of that which remains longer in the ground.

"Accordingly, on the ninth of April 1754, I ordered another bed to be sowed with barley in my presence, and in the manner I have just related. I counted all the grains of each cluster myself. They were sowed in three rows. I varied the experiment in the row next the south, by sowing no clusters there of less than 3, 4, 5, or 6 grains: which I continued the whole length of the row. At harvest, all the clusters in which several grains had been sowed, were so thick that they touched one another.

"What is of most consequence to our culture, is, to know the produce of each cluster. The annexed table shews it particularly. I shall only add, that the clusters, as they are here ranged under their respective numbers, occupied forty feet in length, and that the beds were five feet wide.

EXPLANATION

Of the table of the bed sowed in clusters with barley, and its product.

FIGURE I.

"The south row has 24 numbers.

FIGURE II.

"The middle row has 16 numbers.

FIGURE III.

"The north row has 16 numbers.

"These numbers are subdivided into small squares: in the upper ones of each are the number of grains sowed in each cluster.

"The lower ones contain the number of stalks bearing ears, which each cluster produced.

"Each number contains an equal number of small squares, and under each number of each of these squares, is set down the number of grains that were sowed: those of 4 clusters have 18 grains; those of six, 21.

"The cyphers in some of the lower squares of fig. II. and III. are the places where no plant grew.

R E.

B E D sown with three Rows of Barley,

Fig. I. S O U T

	N ^o . 1.				2.				3.				4.				5.				6.			
Number of Grains sown	6	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3
Number of Stalks produced	44	15	13	15	37	33	20	10	30	24	32	19	38	16	15	14	11	33	8	1				

	N ^o . 13.				14.				15.				16.				17.				18.			
Number of Grains sown	6	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3
Number of Stalks produced	14	3	6	34	18	47	19	20	19	22	10	12	25	9	36	7	22	17	10	15	7	20	18	

Fig. II. M I D D

		N ^o . 1.						2.						3.						4.						
Number of Grains sown	.	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1
Number of Stalks produced		0		4		18		0		5		30		0		6		7		4		5		0		1
			2		10		13		0		17		54		0		18		5		0		27		18	

		N ^o . 9.						10.						11.						12.						
Number of Grains sown	.	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1
Number of Stalks produced		0		9		14		9		2		10		12		16		16		6		20		18		3
			23		10		23		3		14		36		0		17		5		0		3		34	

Fig. III. N O R T

	N ^o . 1.						2.						3.						4.						
Number of Grains sown	6	5	4	3	2	1	6	5	4	3	2	1	6	5	4	3	2	1	6	5	4	3	2	1	6
Number of Stalks produced	8		10		18		31		17		15		52		13		16		46		32		0		37
		26		24		8		36		12		0		21		4		11		47		0		13	

	N ^o . 9.						10.						11.						12.						
Number of Grains sown	6	5	4	3	2	1	6	5	4	3	2	1	6	5	4	3	2	1	6	5	4	3	2	1	6
Number of Stalks produced	71		25		24		50		13		0		24		17		19		2		36		5		34
		25		7		0		36		23		3		28		13		15		0		18		4	

ley, in Clusters, and its Produce:

U T H R O W.

7.						8.						9.						10.						11.						12.					
4	3	6	5	4	3	0	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3		
33		15		16		3		18		20		12		18		8		35		16		25		6		40		20		6		17			
	8		18		9		30		15		27		8		52		28		47		40		20		17		40		20		17				

19.						20.						21.						22.						23.						24.					
4	3	6	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3	6	5	4	3		
7		18		0		13		13		17		11		32		7		32		54		35		26		40		20		47		40			
	20		21		11		23		33		17		25		14		21		17		13		47		40		20		47		40				

D D L E R O W.

5.						6.						7.						8.																							
5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6																
0	18	9	14	23	33	44	0	18	9	14	23	33	44	0	18	9	14	23	33	44	0	18	9	14	23	33	44	0	18	9	14	23	33	44	0	18	9	14	23	33	44

13.						14.						15.						16.																													
5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6																
0	34	3	7	48	10	3	62	4	9	4	28	4	0	14	27	0	34	3	7	48	10	3	62	4	9	4	28	4	0	14	27	0	34	3	7	48	10	3	62	4	9	4	28	4	0	14	27

R T H R O W.

5.												6.												7.												8.											
2	1	6	5	4	3	2	1	6	5	4	3	2	1	6	5	4	3	2	1	6	5	4	3	2	1																						
0		37		21		0		7		31		30		20		12		21		32		10		5																							
	13		20		38		2		7		23		6		11		25		1		12		8		10																						

13.												14.												15.												16.											
2	1	6	5	4	3	2	1	6	5	4	3	2	1	6	5	4	3	2	1	6	5	4	3	2	1																						
5		34		20		27		43		52		8		16		7		16		39		23		4																							
	4		33		35		0		44		3		4		2		26		3		5		17		12																						

RESULTS.

The SOUTH ROW.

sowed with 6, 5, 4, and 3 grains,
produced 661, 624, 447, and 493 stalks.

In all 2225 stalks.

The MIDDLE ROW.

sowed with 1, 2, 3, 4, 5, and 6 grains,
produced 48, 72, 147, 204, 219, and 487 stalks.

In all 1177 stalks.

The NORTH ROW.

sowed with 6, 5, 4, 3, 2, and 1 grains,
produced 502, 372, 345, 276, 200, and 92 stalks.

In all 1787 stalks.

"Consequently the whole number of stalks in the three rows was 5189. They yielded 17 pounds of grain, besides a great quantity that was shed in reaping.

"On the footing of this crop, an arpent of 37 square toises* would contain at least 44 beds five feet wide, which was the breadth of the beds on which this experiment was made. The beds would be 222 feet long: the produce of one of them would be 93 pounds 8 ounces, and that of the 44, 4138 pounds 8 ounces: a very considerable crop, and which might be carried still farther by other experiments of this kind, as we shall soon see.

REMARKS.

"THE following observations deserve the reader's utmost attention. First, By this experiment, I have very nearly effected what I aimed at, viz. to have two or more plants grow so close together as to seem but one; and that at six inches distance from each other. If the three rows had been joined together lengthways, they would have been 120 feet long, and ought to have contained but 240 plants: but the distances, which were marked by gueses, not

H h

being

* The *arpent*, by which M. de Chateau-vieux reckons here, is, as we have elsewhere observed, equal to one acre, and very near $\frac{1}{4}$ of a rood English measure.

being exactly six inches each, 96 clusters were sowed in each row, which made 16 clusters over and above. By this means, several of them were nearer than six inches to one another.

"Two hundred and eighty-eight clusters were sown, all of which produced plants, except 25 which did not sprout, or of which the plants perished. This deficiency is not very considerable: but we must observe, 1. That almost all the places where this happened had been sown with only one or two grains of wheat: 2. That it was in the middle row that the greatest number of plants was wanting: 3. That the south row, in which the smallest quantity sown for any one tuft was three grains, furnished and retained its full number of plants: and lastly, that almost all those which were next to the vacant spaces, were stronger than the rest, and thereby made amends for the loss of the others.

"Secondly, The whole number of the stalks amounted to 5189, which is after the rate of 43 stalks and a quarter to a foot: but it is much more considerable in the south row, which having produced in all 2225 stalks, the proportion is 55 and a half to a foot. The cause of this difference is easily seen. The exposition of that row, to the south, being more favourable than that of the others, may have contributed thereto; but it is very plain that it was chiefly owing to none of the clusters in that row being sown with so few as one or two grains.

"Thirdly, We see that the increase of the stalks was, in general, in proportion to that of the seed; only the clusters that were sown with three grains in the south row, produced 46 stalks more than those which were sown with 4 grains; but still the general result of the three rows remains exactly in the same progression, as appears by the following recapitulation.

"RECAPITULATION.

<i>Stalks produced by 1 grain.</i>	140
2 gr.	272
3 gr.	916
4 gr.	996
5 gr.	1215
6 gr.	1650
<i>Total</i>	<u>5189</u>

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Fourthly,

Fourthly, The ears were nearly equal, at least in two-thirds of the length of the rows: the other third surpassed the rest, as will appear by the following extract of the twelve first numbers of the South row.

No.	produced	stalks
1	87	87
2	122	122
3	91	91
4	99	99
5	82	82
6	66	66
7	78	78
8	100	100
9	87	87
10	116	116
11	148	148
12	68	68

Fifthly, The difference between the produce of the clusters sowed with one and with six grains, is extremely great. The former produced but 140 stalks; the others multiplied to 1650. 'Tis true the number of the clusters of six grains is greatest; which is some small diminution of the difference.

Sixthly, I observed several stalks from which others had shot out, all as strong, and as long, as those from which they derived their origin. They proceeded from the first joint above the surface of the earth, generally at the height of three, four, or five inches, and were two, three, and sometimes four in number. I never perceived this kind of multiplication before; but had, till then, always observed it to be at the neck, or point of separation between the roots which descend, and the stalks which ascend, that the plants branched out.

Seventhly, I suspected, in the summer, what was the cause of the great vigour of the plants of this experiment; but I saw it much plainer after harvest: for, upon pulling up some of the tufts of stubble, I found their roots innumerable. This fact is strictly true. I could not count them upon any one plant that had more than 15 or 20 stalks. These roots were in such bundles, and so confusedly interwoven one with another, that after counting several hundreds of

them, I was forced to give up the task. Their length and thickness was answerable to their number.

"I must now remind the reader of what I said before, that the several accidents which I met with in my first experiments, shewed me it was necessary to increase the quantity of the seed. I did so, by small degrees, from year to year. It is equally important for the success of the new culture, not to run into another extreme by loading the earth with more plants than it can nourish: the crop would be considerably diminished thereby.

"It appears from this experiment, that the plants of the clusters which were sowed with six grains, did not hurt one another: on the contrary, their being sown in that manner proved an advantage, since they produced much more than the others: whence it follows, that one may, without danger, extend the quantity of the seed beyond the limits of the principles of the new husbandry. Its principles are not the less true: but they leave the farmer at liberty to use his own prudence in the application of them, according to the nature of the soil.

"Those principles, which suppose that every plant is to subsist till harvest, reduce the seed to a very small quantity: but numbers of accidents destroy many of them. Our reason ought consequently to tell us, that, without deviating too much from the principles we adopt, we may, and should judiciously stock our land with a sufficient number of plants, in order to guard against unavoidable accidents.

"Still I may be asked, what is that sufficient quantity? I answer, that our experiment shews that sowing six grains together in a cluster, from six to six inches, all the length of the rows, will not be found too thick. By following this rule, one may be almost certain that the whole ground will be stocked with a proper number of plants. This ought, however, to be looked upon only as a general proposition, which it will often be proper to deviate from in the circumstances we are going to mention:

- " *When the sowing season is favourable.*
- " *When the land is well prepared.*
- " *In countries where the winter is seldom severe.*
- " *When the land is but little liable to insects.*
- " *When the land is not in danger of being hurt by too much drought or too much wet. And lastly,*
- " *When the land is good and very fertile.*

In

"In all these, and other such like cases, less seed should be sowed; and, in the contrary cases, more. Prudence, and a careful study of the nature of the soil, ought to be our guides. Two or three years experience will be sufficient to shew us the practice that will be best to follow.

"It will be right to repeat our last mentioned experiment, and even to vary it. In all probability it will afford us still greater lights. It will be right, for example, to sow the clusters with a greater number of grains, beginning with six, the produce of which is known, and going on to seven, eight, and even more, always in clusters, till one comes to a number at which the crop ceases to yield an equal profit. By this means the two extremes may be known, either of too much, or too little seed; and the just proportion will then be easily determined.

"Some farther alterations may likewise be made in this experiment. For example, I placed the grains in the earth so that they touched one another. I will try to put them at some little distance from each other, and to range them in a kind of circle, of about three inches diameter. It is reasonable to think, that the plants may make a greater progress then, as they will not all have one common center: some of them will be nearer to the plowed alley; their roots will reach it more easily than before, and will multiply there which; may render the plants more vigorous.

ARTICLE X.

General disposition for the farther progress of the new Husbandry, and particularly for the crop of 1755.

"IT is with uncommon satisfaction that we see trials of the new husbandry multiply daily. A great number of intelligent persons have sown part of their lands in equally distant rows, with the drill-plough, for the next harvest. We have already several farms, some of which are considerable ones, in the neighbourhood of Geneva, which are no longer sown any other way.

"'Tis much to see this new method thus readily entered into. Those who follow it will soon begin to take a pleasure in calculating, and will be curious to compare the new crops with the old. These calculations will insensibly lead to others, on the

produce

produce of land, when laid out in beds. They will see, that there can be no hazard in making a few trials. Thus it is that several have been determined to cultivate some of their lands this year in beds.

"That these arguments should have their full weight with men capable of reasoning, is not to be wondered at: but I confess I have been agreeably surprized, to find this conviction extend to people who can seldom be prevailed on to leave their beaten track. Some peasants in these parts sent a messenger this winter to tell me, that they began to have a good opinion of the method I practised; that they were astonished at the beauty of my young plants, the like to which they had never seen before; and that if they continued to do well, and met with no accident, I ought to have a prodigious crop. After this preamble, he continued, saying, that he was directed to beg of me to give him the particulars of my experiments; that they should meet, several of them together, to read them over in the winter, and make their little reflections upon them. He concluded with adding: "I believe we shall agree to sow in equally distant rows, with the drill-plough; and perhaps too we may, by and bye, lay our lands out in beds."

"I own I found a great deal of good sense and prudence in this conduct of the peasants. I gave them the experiments of 1753, and sent them word, that both my advice and my drill-plough were at their service, and that it should cost them nothing if they chose to make a trial of it. They have been well satisfied with what they have read, and seem disposed to accept of my offers.

"I have experienced this year, more than ever, the facility with which lands are cultivated in the new way. No part of the farm where I sometimes make a little stay, is any longer cultivated after the old method. The most troublesome part is now over: my lands were sowed in a favourable season; the plants rose extremely well, and flourished perfectly till the beginning of winter: but the severity of the frosts has proved fatal to many parts of my fields, and will certainly be a detriment to my crop.

S E C T.

SECT. V.

Continuation of M. DE CHATEAU-VIEUX'S Experiments in 1755 and 1756.

"MY lands were cultivated in 1755, in the same manner as they had been the years before. I shall therefore not enter into any detail upon that subject. When I sowed my fields, they were very well prepared to receive the seed; the spring was pretty kindly; and towards the end of autumn my corn was very fine, excepting some spots that were attacked with the *rust* so early as the tenth of November: other places in which the plants were strong and healthy, promised a most plentiful crop; and though it was greatly diminished by the winter's frosts, it proved, upon the whole, sufficient to confirm the advantages of the new husbandry, which have been already proved in my former accounts.

"The winter of the year 1754, was a most severe one. The frost, which was excessively intense, lasted a long time, and killed a prodigious number of plants: those that resisted it, lost some of the branches they had shot out in the autumn before, and the plants so weakened, branched but little in the spring. The evil would have been infinitely greater, if the ground had chanced to be full of water, when those extreme hard frosts came on: but luckily it was not very wet.

"This winter was followed by a very dry spring, uncommonly hot, and consequently unfit to recover the corn. The summer, in which there was scarce any rain or dew, but very frequently sultry scorching heats, exhausted the plants in several fields. I was not surprised at it. The seasons were extremely unfavourable to all productions of the earth; and, to add to the misfortune, a vast quantity of worms did likewise considerable damage to the corn.

"However, my wheat rose; the straw was pretty near as long as in the preceding years, and the ears were well filled with grain. The plowings had been well performed, which kept the earth in a state of moisture; less indeed than in 1754, because but very little dew fell in 1755.

"The wheat cultivated in the old way, yielded but few sheaves: the straw was short; the ears were full of grain; and, in general, the quality of the corn was excellent.

"There was room to expect good success from the lands that were

were sown in 1755, for the crop of 1756. The young plants rose extremely well, the ground had been properly prepared, and had the degree of moisture necessary to promote their growth.

" Though some slight frosts were felt towards the latter end of October, they did not prevent the growth of the corn, the cold abating from the twelfth of November, to the end of that month. M. de Reaumur's thermometer was, during that time, at from six to eight degrees above the freezing point. At the same time we had pretty frequent, and often plentiful showers of rain.

" The corn was in very good condition at the beginning of the winter, during which there was scarce any frost, excepting the ten first days of December, when the thermometer fell to about six degrees below the freezing point. During the months of January and February, it was pretty constantly above the freezing point: we had little snow; but pretty frequent rains.

" The spring and summer of 1756, having been extremely rainy, and the earth too much soaked thereby, the plants were poor, and the summer plowings could not be given them. For this reason, I could give several of my fields but one stirring; and others had two. I would not plow whilst the earth was so very wet: it would only have hardened, and as it were kneaded it; and I judged that such bad plowings would have been equally prejudicial to the corn then growing, and to the preparation of the fallow for the next sowing. I found afterwards that I had done right.

" One could not but expect that so unfavourable a season would prove fatal to the corn. I had observed during all the month of April, in which there was no frost, and the thermometer was from five to seven degrees above the freezing point, and towards the end of that month from nine to twelve degrees, that the corn made but little progress, and grew yellow. The distemper continuing to increase, I perceived in May, that the corn was attacked with what is called *the rickets*, (*vid. p. 84.*) The bad state of the roots of these plants, the colour of their blades turned to a blueish green, and yellow at the point, left no room to doubt what ailed them; and from that time it was easy to foresee, that besides the smallness of the number of stalks which the plants had produced, and by which the crop would certainly be scanty, it would be diminished still more, by the ears having but little grain.

" In June, the healthy plants thrived greatly: the straw grew long: but yet the sheaves did not yield so much grain as in the fore-

foregoing years, by about a fifth part, as near as I could judge. The corn was very fine and clean; and had it not been for this accident, I am confident I should have had a very plentiful crop.

" I did not see any one field exempt from this distemper. Exceeding fine corn, cultivated in the old way, was totally infected with it; and the sheaves in general yielded but about half the quantity of corn that they usually do in good years. The grains were very small, and mixed with a great many seeds of weeds.

" These general notions are necessary, in order to form a right judgment of the result of my experiments, which I shall relate in the following order.

" The first article will comprehend the experiment which I made upon all my fields laid out in beds, the last of which now bore their third crop. I have distinguished them by the same numbers as in the former years, and shall add to each the particular observations that relate immediately to it.

" The second article will shew the produce of the lands sowed in equally distant rows, with the drill-plough. I shall make some reflections on the usefulness of this practice, which is certainly always preferable to the common way of sowing.

" I shall prove in the third article, that it is still more profitable to lay the ground out in beds. This proof will result from the calculations and comparisons of the produce in each different way.

ARTICLE I.

Experiments made on fields laid out in beds, the last made of which have borne three succeeding crops. These fields are distinguished by the same numbers as in the foregoing years. Observations relating particularly to each experiment.

EXPERIMENT, No. I.

YEAR 1755.

N. B. *This was made on the same piece of ground on which I made my first experiments in 1751: and this year's crop was the fifth, without any interruption. (v. p. 139. 145. 160. and 188.)*

" I Gave a very full account, in the ninth article of the year 1754, (p. 230.) of the experiment I made in order to be the better able to judge which is the most profitable way of sowing the beds;

I i

and

and to determine what quantity of seed it is most proper to sow, in order to have the greatest crop; and this I called, *sowing in clusters*, at the distance of six inches from the center of the one to that of the other. I shall only remind the reader here, that the spot of ground which was sowed in clusters, with barley, in the spring, was part of a bed, forty feet long, and that the produce of the grain was seventeen pounds weight, besides a considerable quantity that was shed in reaping.

" This experiment, which deserved to be repeated, was tried again the same year, and upon the same ground which I had sowed with barley. This last grain being reaped, I sowed the same bed with wheat, on the twenty-third of September following: but it is to be observed, that I did not plow this spot after the barley was off, but only plucked up the stubble, and made three channels, into which the seed was dropt by hand in clusters six inches distant from one another.

" As in the experiment of 1754, the clusters sowed with six grains, were those which produced the most stalks and grains, I sowed all the clusters with at least six grains, some with seven, and others with eight; keeping all the grains at some little distance from each other. The bed forty feet long contained eighty-three clusters in each row, which were sowed with two ounces six pennyweights of wheat.

" The plants came up very well: I spared no pains to cultivate them; they throve wonderfully till harvest: their blades, stalks, ears, and grains, were very fine; and I preserved them from the birds with a net: but as I would not reap them till they were thoroughly ripe, a great deal was shed in cutting them down, and they yielded me but twenty-eight pounds.

..I. O B S E R V A T I O N S.

" **T** HIS experiment is a farther confirmation of the result of the first which was made in 1754. viz. that six grains are not too great a number to be sowed in a cluster, six inches distant from the next cluster. I had not leisure to count the stalks which each cluster produced; but the twenty-eight pounds of corn which they yielded, seems a sufficient proof.

" The circumstance of not plowing the bed before it was sowed, con-

confirms the advantages of preparing land according to the new husbandry.

"I said that the stubble was plucked up, in order to prepare the bed for being sowed. This shewed me how much stubble helps to enrich land.

"When this bed was sowed, and the corn sprung up, I ordered the furrows which were made before winter, next the outward rows, to be opened for about half the length of that bed, and the stubble to be put into them, and covered over with earth: consequently it was laid in the ground which was cultivated, and in that part of it where the plants were to extend their roots. As the quantity of roots collected there was pretty great, I concluded that the effect ought to be much more sensible than it can be in other fields where the plowman buries them as chance directs. In effect, that part of the bed became much finer than the rest; the plants produced a greater number of stalks; and there is no room to doubt that the stubble was an excellent manure.

YEAR 1756.

"I Purposed to continue sowing this bed in clusters, and to increase the quantity of the seed, in order to see what the effect would be: but, in hopes of better success, I gave up the thoughts I once had of reaping a third crop from this bed without plowing it.

"After one plowing, I sowed it, on the sixteenth of September 1755, in three rows of 93 clusters in each row, and 10 or 15 grains in each cluster: and in order to place them with some kind of regularity, I made use of an iron hoop, about three inches in diameter, which was laid upon the ground at each place that was to be sowed, and the grains were dropt at nearly equal distances, some round the inside, and some in the middle of this circle. Each cluster was sowed in this manner. The space from one center to another, was about five inches. The seed was covered over lightly, with a rake, and the quantity employed in this operation, was five ounces twelve pennyweights.

"This wheat was always very fine, from its first rising, till harvest. It was reaped on the thirty-first of July, and yielded twenty-three pounds of grain.

OBSERVATIONS.

"**THOUGH** the produce of this bed was less this year than in 1755, I did not think it ought to be imputed to the increase of the quantity of seed that was sowed, because the plants were as strong as could be wished, their straw as long as in the former years, and their ears as big: but I observed that this bed had not been quite free from sickness, and that it contained a pretty considerable number of rickety plants, which yielded but little grain.

"It results from this experiment, that a certain quantity of seed is necessary, to counterbalance the many accidents to which corn is perpetually liable.

"Though this bed might have yielded a greater quantity of grain in a more kindly year; yet its product, even in this, was very considerable: for if we reckon in proportion the produce of an arpent, which I suppose to consist of 100 square perches (the perch of 22 feet) containing 484 square feet, the breadth of which make four beds of five feet and an half wide each, it would yield 3795 pounds of grain, produced by 56 pounds, 10 ounces of seed: which is after the rate of 67 for 1.

"To this it will be objected, that tho' a small spot of ground, like that we have been speaking of, was made to produce so considerable a quantity of grain; it would probably not be possible to obtain such a crop in proportion from an extent of some acres of land.—It may be so: but supposing the crop to be even greatly inferior, it would still be much more considerable than the common crops.

"Let us examine this question more minutely. It is of great consequence not to embrace an opinion, and especially a disadvantageous one, before it has been carefully considered. Let us see then to what the diminution of the crop may be owing. I say nothing of the particular accidents which may in general lessen crops: but, supposing all things equal, in such an extent of ground, my opinion is, that the first and essential cause of the miscarriage, can be imputed only to the cultivator himself, who sees what is best to be done, but neglects it; and who ought at least to endeavour, as much as possibly he can, to do that in great, which he sees succeed so well in small.

"I grant

" I grant that many reflections, and reasonings, which seem at first sight extremely just and apposite, are in reality oftentimes only specious and deceitful, and that it is always right to recur to experimental proofs. Luckily we have such ready to produce.

" The celebrated Wolfius observed long ago, that the productions of plants which grow in large pieces of ground, are always fine when the seed has been properly buried, and sowed thin: whence he concluded, that the most extensive fields ought to produce as much in proportion as small ones, and that it is evident that whenever an experiment has been made with the necessary precautions, and has succeeded upon the tenth part of any piece of ground, it ought to succeed equally upon two, three, or four tenths, and consequently upon the whole of that ground.

" The experience of five years, of which I shall give an account in the following article, will, I believe, prove this very sufficiently.

EXPERIMENT, No. II.

N. B. This field is marked with the same number in the former experiments.

For the crop of 1752, (p. 147.) it was sowed with 11 pounds 4 ounces of wheat, which produced 1041 pounds 12 ounces.

For the crop of 1753, (p. 161.) it was sowed with 34 pounds 14 ounces, which produced 1575 pounds.

For the crop of 1754, (p. 194.) it was sowed with 61 pounds 14 ounces, which produced 1820 pounds.

For the crop of 1755, it was sowed with 78 pounds, which produced 1950 pounds.

For the crop of 1756, it was sowed with 51 pounds, which produced 1885 pounds.

YEAR 1755.

" I Had now cultivated Smyrna wheat for some years, sowing the whole of each year's produce, in order to increase my quantity so as to be able to sow a pretty large field with it; which I could not complete till 1754, for the crop of 1755.

" The field in question was sowed with 78 pounds of this corn. It rose very well: but towards the end of winter, I was surprised to find that a great quantity of plants had been destroyed by the frost; and I soon perceived, that almost all the strongest and healthiest

healthiest plants were those of common wheat, and that there were very few of Smyrna wheat. I had observed at the time of sowing, that there was some mixture in the seed: and as I had some of the same sort still remaining, I was able to satisfy myself that there was a third part of common wheat in the Smyrna corn which I had sowed; and that it was the former which grew so fine, and of which almost the whole crop consisted.

"This shews that Smyrna wheat does not resist hard frosts; but at the same time, such winters as that of 1754, very seldom happen in this country. This field was reaped on the nineteenth of July: the common wheat was thorough ripe, and the Smyrna wheat quite green, though its grain was grown very hard.

"I separated the ears of Smyrna wheat from the others, in order to bind them up in distinct sheaves, that I might have their grain pure and unmixed. This field produced 212 pounds of Smyrna wheat, and 1737 pounds of common wheat; in all 1950 pounds: which is a greater crop than that of the preceding years.

OBSERVATIONS on Smyrna wheat.

"MY former crops of this wheat, though the quantity was but small, had already shewed me plainly that it produces more grain than any other kind. In 1755, the sheaves of this wheat, of the same size as those of our common wheat, yielded more grain by half than the others did. It is therefore probable, that the planting of this grain will be attended with advantage, especially in climates not subject to hard frosts.

"But what is of very great importance, is, to know well at what degree of maturity this corn should be reaped. The two first years that I sowed any of it, the ears were prodigiously big, and full of very plump well-fed grain: but I was uneasy not to see them ripen. They continued green, whilst I expected daily that they would turn yellow, and the grain grow hard; but in vain. By this delay, the grain wasted so much, that I never saw any smaller, nor so much shrunk as these. However they sprouted well when sowed, and produced very fine plants.

"The third year, I determined to reap them sooner than I had done the first. Accordingly, I cut them down as soon as I found that the grain had acquired a sufficient degree of hardness, notwithstanding that the corn was still quite green. The consequence of this was, that the grain remained exceeding plump and fine.

YEAR

YEAR 1736.

"I Continued to sow the same field with Smyrna wheat, of which I procured some quite pure and unmixed. I sowed 51 pounds of this wheat, on the first of October. The plants were fine, and sufficiently forward before winter, and thrived prodigiously from spring till harvest. But I ought not to omit observing, that Smyrna wheat is as apt to be *rickety* as common wheat, and that numbers of these plants were affected with that distemper.

"This crop was reaped on the twenty-ninth of July, being still green, and the grain only hardened. It yielded 1885 pounds of exceeding fine, clean, good-sized wheat.

OBSERVATIONS.

"IT would answer no end to make experiments, if one were not to attend to the instructions they may afford: but as those instructions will sometimes escape the notice even of the most careful observer, it is proper always to repeat the experiments, and to continue them constantly for some time. It is by so doing, that the advantages of the new husbandry will appear in their true light, and be established beyond dispute.

"The field I am now speaking of, and from which I reaped five crops, in five years immediately following one another, presents us real and very considerable advantages, which I shall set forth in what appears to me the justest and most striking manner.

"To this end, I shall state exactly the products of the field in question, cultivated in the old and in the new way. I shall begin with its produce during sixteen years that it was cultivated according to the rules of the old husbandry; namely, from the crop of 1730, to that of 1744 inclusively. In this space of time it produced eight crops; the custom of the country being to sow but once in two years, and to rest the ground each alternate year. My account may be depended upon, as perfectly exact. I have extracted it out of a journal kept by a steward of mine, who died in 1745, and who was scrupulously exact even in the smallest concerns.

"After giving the produce of this field, the soil of which is very good and strong, during sixteen years that it was cultivated in the old way; I shall shew what the same field produced in five years cultivation according to the new method, in order to compare the different products of only five years to sixteen; and afterwards draw a comparison between both the cultures for sixteen years, sup-

supposing, which is a great disadvantage, that the eleven remaining years of the new husbandry produce no more than these first five years.

Number I.

" Produce of the field Number II, during sixteen years that it was cultivated in the old way, viz. from the crop of the year 1730, to that of the year 1744, inclusively.

S O W E D.

	Pounds.
In 1729.	267
	Pounds.
1731. { Wheat	425
{ Barbary Wheat	63
	488
1733. Wheat	441
1735. Wheat	504
1737. English Wheat	441
1739. Wheat	441
1741. Wheat	472
1743. Wheat mixed with tares	504
Total seed of eight years	<u>3558</u>

R E A P E D.

	Pounds.
In 1730.	1134
1732. { A Year extremely bad, on account of the great quantity of flugs which de- stroyed the wheat, and the many seeds of weeds that it was mixed with	1606
1734.	1953
1736.	1008
1738.	977
1740.	1291
1742.	1638
1744.	1512
" Total amount of the crops of eight years, in the space of sixteen years	<u>11119</u>
	Brought

" Brought over; Total amount of the crops of eight } 11119
years, in the space of sixteen years. . . .

To be deducted.

	Pounds.
Siftings of 1732	756
* Siftings of the other years	1009
Seed, as above	3558
	5323

" Remains, for the neat produce of sixteen years, . . . 5796

* " This field always produced clean corn; greater pains being taken to keep it free from weeds, than could be bestowed upon other pieces of ground, more distant or more extensive. The siftings would otherwise have been more considerable in so great a number of years.

Number II.

" Produce of the field Number II, during five years of culture in the new way.

S O W E D.

	Pounds.	Ounces.
In 1751. Wheat	11	4
1752. Wheat	34	14
1753. Wheat	61	14
1754. Smyrna wheat	78	
1755. Smyrna wheat	51	
	237	0

Total seed of five years

R E A P E D.

	Pounds.	Ounces.
In 1752.	1041	12
1753.	1575	
1754.	1820	
1755.	1950	
1756.	1885	

" Total amount of the crops of five years . . . 8271 12

" To be deducted for the seed, as above . . . 237

There was no sifting.

" Remains for the neat produce of the five } 8034 12
years

K k

Number

Number III.

" Comparison of the above produce of the new culture, with that of the old.

	Pounds.	Ounces.
The new husbandry produced in five years, without any intermediate year of rest	8034	12
The old husbandry produced, in sixteen years,	5796	

" Consequently the new husbandry produced in five years, more than the old did in sixteen, by

2238 12

Number IV.

" Farther comparison of the produce of the new husbandry with that of the old, as above.

NEW HUSBANDRY.

	Pounds.	Ounces.
" The new husbandry produced in five years	8034	12
" Supposing the crops to be the same for eleven years more, they would amount to	17676	7
" And for sixteen years, to	25711	3

OLD HUSBANDRY.

The neat produce of the old husbandry, in sixteen years, was	5796	
" The balance in favour of the new husbandry, would consequently be, in sixteen years	19915	3

REFLECTIONS and OBSERVATIONS.

" I Dare to say that very few of those who might just have glanced over the product of the five years during which the field No. 2. was

was cultivated in the new way, would have imagined the advantage to be near so great as it really is, had not the above comparisons been likewise laid before them. If nothing but the hope of great profit can recommend the new husbandry to the general practice of our farmers, the above calculations ought at once to determine them; since they here see that the same field produced much more grain in five years, and even in four, when managed in the new way; than it produced before in sixteen years, whilst cultivated according to the old method. I confess that when I first began to practise the new husbandry, I did not expect so great advantages. They might have been greater still, if I had not committed in the first years, faults which considerably diminished the crops of 1752 and 1753. Besides those first faults, I committed another which also greatly lessened my crops. I was not aware that *every field that is plowed deeper than it has usually been, often loses of its fertility for some years, unless it be assisted by a sufficient quantity of manure.* The new earth which is brought up to the surface, by these plowings, remains so hard and compact that it cannot be fit for the nourishment of plants, till after it has been well broken by repeated plowings, and as it were ripened by the influence of the air, &c.

“ This observation will be particularly useful to all beginners in the new husbandry. They must not be surprized if their first crops do not answer their wishes: but the deeper they plow at first, the greater success they may justly expect afterwards. In the mean time they must suffer patiently the inconvenience I have been speaking of, or remedy it by using a great deal of manure.

“ Would it be reasonable to desire greater advantages than those we have proved above? any man of sense may surely be satisfied with them. But by what fatality does it happen, that infinite numbers will not, or cannot see them? I know, for instance, that except a certain number of persons who have studied the new husbandry thoroughly, or practised it with care, it is generally thought in this country, that the field No. 2. which I have been speaking of, has produced me less corn than it would have done if it had continued to be cultivated in the old way. Whence does this notion arise? Surely from this, *that men are apt to judge too precipitately, without examining sufficiently, or calculating right.* Whoever really wishes to be informed, and desires to promote the public welfare, and his own private good, may easily attain those ends; but it must be by a

different road from that which is commonly pursued: it must be by reckoning and calculating, as I have done with regard to the field in question.

"Some fields will not yield so much as this has done: but yet their produce will be such as must determine all unprejudiced persons in favour of the new husbandry, as I shall demonstrate by the calculations in the third and fourth articles.

EXPERIMENT, No. III.

"N. B. *The field on which this experiment was made, contains about an acre of ground. I have joined it to that of the experiment No. 7, under which its produce is included.*

EXPERIMENT, No. IV.

Sowed	lb. oz.	lb. oz.
In 1753 . . .	181 . . .	reaped 3370
1754 . . .	268 14 . . .	4972 8
1755 1st half . . .	488 . . .	5850
2d half . . .	488 . . .	2080
1756 . . .	816 . . .	3640

YEAR 1755.

"ONE half of this field was laid out in beds in 1753; (p. 167.) and the other half, not till 1754, (p. 196.) I shall begin with the oldest, from which I had reason to expect the best crop, the ground being best prepared. It was sowed on the 27th and 28th of August, with 488 pounds of wheat. This was a considerable increase of seed. I judged it necessary, and so it proved; for it preserved this field from being greatly hurt by the frosts in winter, which destroyed a great number of plants. If they had not been so thick sown, I make no doubt but that the crop would have been considerably diminished. This half was reaped on the 18th of July, and yielded 5850 pounds of very fine grain. Here is a crop considerably greater than the former. It exceeds the first by 2480 pounds.

"The other half of this field now bore its second crop. The same quantity of seed (418 lb.) was sowed, but did not produce so much as in the other half. As this part lies in a bottom, the frost hurt it more

more than it did the other, nor had it been so long laid out in beds; besides which, the rains hindered me from sowing it at the same time as the other half. It could not be sowed till the 21st, 22d, 23d, and 24th of October, which is somewhat late. It was reaped on the 19th of July, and yielded 2080 pounds of wheat.

YEAR 1756.

"THIS field was sowed on the 9th, 10th, and 12th of September, with 816 pounds of wheat and reaped on the 28th and 29th of July. The produce was 3640 pounds.

OBSERVATIONS.

"ONE might justly be surprized at the scantiness of this crop, if, besides, what I said before, of the general causes which were so prejudicial to this year's crop, I did not add those which may have more particularly affected this field. My intention was to sow it thicker than it chanced to be, by the sower's not following my directions. The hurt might perhaps not have been considerable, if the year had proved kindly: but it was of great consequence this year, and particularly in this field, in which all the corn was extremely rickety.

EXPERIMENT, No. V.

Sowed	lb.	Reaped lb.
In 1753 (p. 170.)	139	2205
1754 (p. 197.)	224	2283
1755	388	2600
1756	544	2700

YEAR 1755.

"THIS field still continued to be difficult to bring to good tilth; and therefore required the more seed. It was sowed on the 29th of August, reaped the 29th of July, and produced 2600 pounds of grain.

YEAR 1756.

"I Thought it necessary to continue to increase the seed of this field. It was sowed the 20th and 22d of September, with 544 pounds of wheat. The young plants looked very fine before winter, and

and promised better than those of the preceding year. The general accidents of the year affected them. They were reaped the 16th of July, and yielded 2700 pounds of corn.

EXPERIMENT, No. VI.

Sowed	lb.	Reaped lb.
For 1753 (p. 170.)	45	724
1754 (p. 108.)	82	798
1755 wheat	126	900
1755 barley	12	nothing
1756 beans and tares	153	value in wheat 780

2 V O T A N 1 7 5 5

THIS field is one of those in which the stiffness of the soil resisted longest that degree of pulverisation in which the chief merit of the new husbandry consists. The first crops were not considerable. In 1754, I could not sow this ground before the 15th of October, and yet the plants which it produced were very fine. It was reaped on the 21st of July, and produced 900 pounds of wheat. The most remarkable thing in this field, was what happened to some beds which I had sowed with 12 pounds of barley. The young plants were exceeding fine in autumn, but the hard frosts of the winter killed every one of them.

“As soon as I perceived this loss, I endeavoured to repair it, by sowing the same beds again with spring barley; and as the two wheat beds next to them had likewise suffered so much as to have but few plants left; I sowed them also with barley.

“These beds were sowed without being plowed again. The whole charge of this second sowing consisted in passing the drill once over them, and in 28 pounds weight of barley which was used for the seed. This was done the eighth of April.

“This barley grew very fine. It was reaped on the first of August, and yielded 270 pounds of grain. I doubt whether that which was sowed before the winter, could have produced more: so that I think this crop made me ample amends for the loss of my first seed.

“How great a proof is this of the excellence of the new husbandry! and how easy a means does this husbandry afford, of guarding against dearth, when our young crops chance to be destroyed, by the facility with which the same lands may be sowed again, without loss of time,

time, and with scarce any more expence than the bare cost of other seed, which, in such times of general distress, will produce crops of other useful grains, even more profitable than those of wheat! An inestimable advantage, which secures the subsistence of the people, and which cannot be obtained by the old husbandry. This must be evident to every one who considers that all that is requisite, in such a case, in the new husbandry, is only to sow again; whereas in the old way, the husbandman is obliged to plow before he sows, to sow a great deal of seed, and to harrow that seed in after it is sown. The vast saving made in the seed, in the new way, is likewise another very important article in a time of scarcity.

"I reason here upon a supposition of the total loss of all the crops of wheat, which really was the case in 1709.

YEAR 1756.

"I Reserved this field to sow it in the spring, with the grain of that season, with which I had not yet made any experiment, except in small spots of ground. I plowed it before winter: the new beds were well made, and the earth was in such fine tilth in the spring, that I thought I might safely sow it without any farther plowing. Accordingly I did so, on the 26th of April; the too great wetness of the earth not permitting it to be done sooner. One half of this field was sowed with beans, and the other half with tares; in all, 153 pounds of both; which produced a crop equal in value to 780 pounds of wheat.

OBSERVATIONS

"THIS year was extremely bad for all grains sown in the spring: most of which yielded but the value of the seed: so that the produce of this field, compared to that of others cultivated in the old way, ought to appear very considerable.

"The success of this experiment shews, that when too much rain, or too great drought hinders plowing the land in due time, and some fields cannot be prepared for wheat in the autumn, they may be sowed the spring following with the different grains usually planted in March.

EXPERIMENT, No. VII.

Sowed	lb.	Reaped lb.
For 1753 (p. 171.)	412	2646
1754 (p. 198.)	360	2467
1755 including the ex-	639	4290
periment, No. 3.	1010	6760

YEAR 1755.

"THE soil of this field is of such a nature as to require a greater quantity of seed than many others. I shall doubtless be thought to have increased it greatly, in having enlarged that quantity to 639 pounds: and yet this year's experiment makes me judge, that it will be still necessary to sow more another time.

"I sowed this field on the 9th, 10th, and 26th of August, and reaped it on the 16th and 17th of July. It yielded 4290 pounds of grain.

YEAR 1756.

"I Have a meadow adjoining to this field. I plowed up part of it, which had produced but very little grass for a long time, and turned it into arable land. This addition served to replace another part of the field, which I sowed with lucerne. This last part being less than that which was added from the meadow, the field may have been enlarged about two acres, and the soil is much the better for it.

"This field was sowed with 1010 pounds of wheat, on the 10th, 13th, and 15th of September, and was reaped the 23d and 24th of July, when it produced 6760 pound weight of corn.

EXPERIMENT, No. VIII.

	lb. oz.	lb.
For 1754 was sowed (p. 203.)	76 8	which yielded 1462
1755	157	1300
1756	230	2080

YEAR

these plants were ready to be sown, some of which could
which was not a little strengthened by my perceiving that several of

"THIS great increase of the quantity of seed might be wondered at, if I did not observe that this field was sowed with a double turn of the drill-plough; by which means each bed (for they were all wide enough to admit of it) had six rows of plants instead of three, and consequently took up double the quantity of seed. The event will shew that I was right in so doing.

“ This field was sowed on the 31st of August, with 157 pounds of wheat. Nothing could make a finer appearance than this field did at the beginning of winter. The plants, which had already branched very abundantly, made the ground look surprisngly thick covered. The strength of the stems, and the deep green of the blades made me expect extraordinary success. They continued thus promising during all the winter; and the same in February and March, and to the middle of April.

“The soil of this field is excellent: but it could not be preserved from the fatal effect of the severe frosts in winter. I was extremely surprised when, going thither on the 27th of April, I found this wheat, which I had seen twelve days before without the least symptom of decay, reduced to a most deplorable condition: not a single stalk remained that was not dead, not a blade that was not withered. Both the stalks and the blades adhered so little to the plants, that one might rake them up in heaps, like grass that has been mowed: in short, nothing could be more melancholy than the appearance of this field.

"The earth was extremely dry, and the weather very hot for the season: from the 16th to the 24th of April, M. de Reaumur's thermometer was almost always at seven o'clock in the morning, from 15 to 18 degrees above the freezing point. I am apt to think that this uncommon temperature of the air completed what the hard frosts had begun, and which I did not perceive before.

“ My first thought was, to sow the field again with barley, as I had done in the case of the experiment, No. VI. but seeing that the disaster was general, I examined most of the plants with great attention. I ordered the earth to be dug, and found some plants quite dead, and others, in pretty great number, which had still some vigour, and were provided with very good roots, and of which only the stems and blades had perished. This gave me some hope; which

which was not a little strengthened by my perceiving that several of these plants were ready to produce new shoots, some of which could just be distinguished by their white point, scarcely perceptible; others were about the 12th part of an inch long, and others a quarter or half an inch: these last began to look green.

Several reasons induced me to think that these plants might still be strong enough to produce new stalks, especially if a little rain should chance to fall. I therefore resolved not to sow this field again. Fortunately, a good shower of rain fell the 29th, which did them a wonderful service. I went to see them soon after, and found the new shoots considerably grown: upon which I determined to cultivate the beds with care. By the middle of May, they were grown very fine, were loaded with blades and stalks, and only seemed much thinner than in the autumn: the straw was as long, the ears as big, and as full of grain as the year before. I was obliged to reap this corn early, because, as the heat of the weather had precipitated the ripening of the grain, it might have shrunk and shrivelled if I had let it stand some days longer. It was cut down the 17th of July, and yielded 1300 pound weight of grain.

"I am persuaded that this accident diminished the crop by above half; and this is certainly the reason why it produced less than that of 1754.

"The shape of this field was irregular on the north side. The length of the beds in that part decreased progressively, so that those next the end were not above three or four perches long. This made the tilling of them very troublesome, because of the frequent necessity of turning the plough. I ordered this triangular part, which was about a third of the field, to be plowed for sowing in equally distant rows with the drill-plough. The rest was preserved in beds, as in the preceding years.

"I sowed it on the 17th of September, with 230 pounds of wheat, which was reaped the 24th of July, and yielded 2080 pounds of grain.

EXPERIMENT. No. IX.

For 1754 was sowed (p. 203.) 249 12 lb. which yielded 2925 lb.
 1755 312 1362
 1756 295 2219

YEAR

"THIS field, which had been well prepared, was sowed on the 27th of August, with 312 pounds of wheat, which grew very fine and thick till November: but from the 10th to the 18th of that month, a general frost seized it. I imputed to this distemper the smallness of the crop, which amounted only to 1362 pounds.

YEAR 1756.

"THE ground was extremely well prepared, and better than the preceding years. It was sowed on the 24th of September with 295 pounds of wheat, which produced 2210 pounds. It was reaped the 21st of July.

EXPERIMENT, No. X.

	lb.		lb.
For 1754 (p. 204.) was sowed 294		which yielded	3055
1755	397		2210
1756 rye	348		2700

YEAR 1755.

"THIS field was sowed on the 30th of August, with 397 pounds of wheat, which produced 2210 pounds. I make the same remarks on this experiment, as on the preceding No. IX. year 1755.

YEAR 1756.

"THOUGH it is not usual for me to sow rye, because all my lands are fit to bear wheat, I was willing to make a trial with that grain; and accordingly I sowed this field with it, on the 16th of September. The quantity employed was 348 pounds. The straw was very long, and much thicker than that of rye in the common way: the grains too were considerably larger. It was reaped on the 19th and 20th of July, and yielded 2700 pounds of grain.

EXPERIMENT, No. XI.

Executed by the same person who made those of 1754, marked with the same number, (p. 208.) and those of 1753 marked No. IX. (p. 172.)

“THOUGH the following extract does not agree exactly with the title of this article, I was unwilling to make a separate one of it. It contains very interesting details: the most essential circumstances are related with great precision; and the consequences of the results are established by very instructive calculations. They shew the writer of them to be a studious husbandman, a very skillful naturalist, a zealous lover of the public good, who instructs by his example, and still more by his knowledge.

“These experiments were made about fifteen miles from Geneva, in a country where it is the custom to sow their land two years running. The first year, it is sowed with wheat; the second, with spring corn; and the third, it rested.

Extract of a letter dated December 7th, 1755.

“I received the journal of your last year's experiments, and have read it with very great pleasure. If it were possible for me to make any observation of the least importance, upon your experiments, which had escaped you, I should take the liberty to lay it before you, persuaded that you would receive it kindly.

“In general, I ascribe, as you have done, the different success of the new husbandry, 1. To the intrinsic quality of the soils, some of which seem unfit for the production of wheat; 2. To the condition of the lands, when they first began to be cultivated in the new way: 3. To the manner in which they were prepared according to the principles of this husbandry: and lastly, to the quantity of seed that was used.

“I was particularly pleased with your experiment on the barley. It is certainly very instructing, and confirms what I before suspected, that, in our climate, wheat and other plants love society; and that they thrive better when numbers of them are planted together, than they would do separately, provided that number be not too great. You will certainly not fail to repeat that experiment in years less hot and less dry, and upon other plants. Still I am afraid that no fixed rule can ever be given in relation to the quantity of the seed: too many circumstances influence the condition

"dition of the soil; but it will always be of great service to fix certain bounds, within which every one may chuse what suits him best.

"You will see by the account of my little experiments, that I have sowed in the ground of my rows, nearly what would have been sowed by hand in the same space. But the imperfection of my drill-plough, and the condition of my land, obliged me so to do; and I have not hitherto found any inconvenience from it.

"I shorten my reflections, and proceed to my experiments.

Produce of the first and second crop of a field cultivated in the new way.

"This field contains, according to our measure, six *poses*. Each *pose* contains 400 square perches, and each perch nine feet: so that the whole extent of this field is 5400 perches, of six feet to the perch.

"The soil is tolerably good; rather light than strong; fitter for rye than for wheat. I am the first that ever ventured to sow it with wheat. Dung used to have a great effect upon it for the first crop; but the second seldom succeeded: in short, it was the general opinion, that nothing could be made of this field without the help of a great deal of good manure.

"It was well dunged in 1749, and sowed with Massin corn. The year 1750 was very favourable to corn in general, and particularly to that of this field. It yielded as much as two middling crops; that is to say, ten for one: but being sowed again the same year, it yielded in 1751, only two and a half for one. The year 1752 was the year of rest, or rather it was plowed that year, according to the old method, and sown in the broad-cast way, but without dung. The autumn was not kindly: the plants rose poorly; and the crop of 1753 yielded scarce three for one, after deducting the tythe. It was after this crop that this field was laid out in beds of six feet wide, and sowed the same year with wheat. As the mould of these beds could not be prepared properly, and the year 1754 was but a poor one for wheat, I was not surprised at the scantiness of the crop. I sowed 12 of our measures, and reaped 72. Our measure of wheat weighs, when it is good, 28 pounds; and that of Massin, 26 pounds. I did not weigh mine every year; but I am sure it was always full weight.

"Encouraged, rather than disheartened, by this trial, I plowed these

“ these beds up for a new crop, and sowed them, part with Maslin
“ corn, and part with wheat.

“ The summer of 1754 was so dry, that I deferred plowing the
“ back of the beds which had borne their crops, till the end of
“ autumn. This was attended with these two inconveniencies: first,
“ that the intermediate earth, which had been well pulverised, being
“ no longer supported as before, slipped away from under the drill,
“ and spread to the right and left; by which means the plants had
“ less depth of good mould left, and I lost part of the advantage I
“ hoped for from this culture. The other inconvenience was, that
“ the beds being no longer so high raised as they should have been,
“ the first plowing in autumn covered their outmost rows in several
“ places: a loss, by so much the more considerable, as the rows so
“ buried would, by their situation, have otherwise been the finest of
“ all. I certainly under-rate it in valuing it at only a tenth part of
“ the crop.

“ As Maslin is a much quicker grower than wheat, and being
“ uncertain whether it would do without dung; out of 18 beds, I
“ dunged 12, but very slightly; just as I should have dunged the
“ third part of this ground, if I had intended to sow it in the broad-
“ cast-way.

“ I sowed it on the 4th and 5th of October, 1754, with two
“ turns of the drill-plough, and very thick; by reason of the im-
“ perfection of my drill, and because the season was already some-
“ what advanced. A third more seed was sowed this year than the
“ last, viz. 18 of our measures.

“ The plants rose well, the rows looked very thick and well
“ filled, except those which were hurt by the first autumn plowing,
“ and by cattle which broke in upon the ground, and did a deal of
“ damage.

“ The plants in the part which had been dunged, were very fine
“ all the winter. In the beginning of April they grew with surpri-
“ sing vigour, and were as beautiful as could possibly be in May and
“ June. They were so tall, that they hid my plough and horses, and
“ seemed to promise three times more than the other plants where
“ the ground had not been dunged. These last grew more slowly;
“ but just before harvest, they pushed strongly; and if their straw
“ was not so long or so thick as that of the former, there was scarce
“ any difference in the length of the ears; and the difference of the
“ produce was but one fourth in favour of the dunged plants.

“ Both

"Both the one and the other suffered on the 23d of May, by a violent north-east wind, which broke a great number of the stalks of the rye, and tore others up by the roots. The stalks that were not quite broke, recovered perfectly, and the loss was not great with respect to them. The case was different in regard to the plants that were broke asunder or torn up. I reckoned the damage sustained by these last, equal to a tenth part of the crop.

"Of the 47 furrows of this field, 18 sowed with Massin yielded me (exclusive of the tythe which is an eleventh part) 60 of our measures. This grain is the finest of its kind in the whole country, and is equal to common wheat. It weighed in the driest and coldest season, 27 pounds; which is a ninth part more than the common Massin.

"The 29 furrows sowed with wheat, seemed to have escaped the violent frosts of the winter; but I was greatly surprized in April, to see large spaces in which the plants perished daily; and others wherein the wheat seemed to have disappeared, to make room for a prodigious quantity of seavy which looked extremely well.

"I was not at all pleased with this change of crop; and though I no longer expected any thing from these damaged places, which amounted to the value of nine furrows, I would not give up the good plants which I thought might still be in them; and therefore ordered them to be weeded carefully and several times over, by women who desired only the weeds for their labour. This operation was not useless: the surviving plants gathered new strength: they branched considerably in June; and yielded me, at harvest, about a third part of what I reaped from the places which had not been damaged. These last seemed but indifferent during all the spring. Every one judged this corn inferior to that of the fields which had been sown in equally distant rows and dunged: but from the beginning of June, when the other wheat began to decline, my rows throve so well, that some parts of them were very greatly superior, both in the length of the straw, and the big-

* Great part of this field seems to have suffered exactly the same accident which happened to the whole field of the experiment, No. 8. It was not perceived in either of them, till April; and the effect was the same upon the plants in both cases, tho' they were more affected in one than in the other. In both cases too, the plants recovered and yielded a good crop.

"ness of the ears, which last were every where longer and better
 "filled. Notwithstanding all this, my wheat had still more to suffer. It
 "was cut just before the heavy rains in July, and some of it sprouted,
 "as was the case elsewhere. Besides the loss in the quality of the
 "grain, my threshers reckoned that the quantity of it was diminished
 "eight measures. The whole produce was but 68 measures, after
 "deducting the tythe.

"I have entered into this detail: in order to make the following
 "remarks.

"1. This field, twelve furrows excepted, not having been dunged
 "so early as in the year 1749, the superiority of the crop of 1755 over
 "that of 1754, must be imputed chiefly to the new husbandry. The
 "places on which my finest wheat grew, were not at all extraordi-
 "nary in 1754, and yet they were not dunged for 1755: consequently
 "the culture, far from exhausting, meliorated the ground.

"2. Some soils are fitter to produce some grains than others;
 "and it is in vain to attempt to force nature. Notwithstanding
 "the good culture, the bad part of my field was yet worse than
 "in 1754; but the senvy in it was finer. I sowed this part with
 "grass, and it is still covered with the same plants, very green and
 "vigorous. I judge that rhadishes or turnips could do very well
 "there.

"3. One must not always judge of a crop, by the appearance of
 "the green corn in April and May; because the dung then exerts
 "its greatest strength for the production of the blades, and that ap-
 "pearance is oftentimes deceitful.

"4. The last plowings ought, if possible, never to be neglected:
 "it is to them that I ascribe the favourable change which happened
 "to my wheat.

"To follow your method, I have now only to compare the pro-
 "duce of this field, with what it yielded when cultivated in the old
 "way. I have not been able to find its exact product before the
 "year 1750. All I know, is, that the crops varied extremely, ac-
 "cording as the ground had, or had not been dunged, or the year
 "was more or less kindly.

"I shall therefore estimate the products of this, by that of the
 "neighbouring fields, which are thought to bear a good crop, when
 "a *perk* of land yields 32 of our measures, after deducting the tythe
 "and seed-corn. The next crop, whether it be of winter or of
 spring

"spring corn, is seldom worth half the first: however, supposing it
"to be 16 measures, as the land is rested the third year, the neat
"produce of the crop for three years will be 48 measures; which is
"16 measures a year, and 96 measures for the six *poses*.

"I had, in the new way, 128 measures of wheat and maſlin;
"deducting from which 18 measures for the seed, there remain
"neat 110 measures, and a profit of 14; for which I am indebted
"to the new husbandry.

"If we add to this, the eight measures lost by the sprouting
"of the grain, and the damage done by the plowing in autumn, it
"will appear that, without those two extraordinary accidents, I
"should have had 35 measures more than could have been expected
"in the old way, and that of a corn, which, supposing all other
"things equal, is worth 12 *per cent.* more than any of the common
"growth.

"I make no doubt but that if I were to lay upon my furrows the
"dung that is spread yearly upon my lands, and were to take all the
"precautions necessary to sow and cultivate them properly, the neat
"produce would be 30 measures, one year with another; which
"would be a continual plenty.

"However that may be, thus much is certain in favour of the
"new husbandry, that, notwithstanding all the accidents, my field
"produced the second year above double the quantity that it did
"the first.

*First year's produce of a field sowed and cultivated according to the
new husbandry.*

"This field contains about 1900 of our perches, or 4200 perches
"of six feet to the perch. It was divided into beds five feet wide,
"which were sown alternately with one and with two turns of the
"drill-plough, that is to say, with three rows and with six. The
"plowings had been but badly performed, and the beds were not
"raised or arched so high as they should have been. Those that
"were sown double, that is with six rows, were always superior to
"the rest. As the soil of this field is generally strong, and fit for
"wheat, it did not afford the same variations as the former; though
"some of this wheat sprouted also.

"I sowed 17 measures, and reaped 92; besides the tythe. By the
"same calculations as before, the neat produce was one measure less
"than in the old way.

M m

" But

“ But it is to be observed, 1. That by the sprouting of the grain, I lost more in this field than in the other. 2. That this was not a good year for wheat. 3. That this field, being bordered by two highways, and not being inclosed, was greatly damaged by cattle that got into it. 4. That what grain I did reap was clean, and suffered scarce any diminution by sifting. 5. That if I had sowed all my beds with six rows, I should probably have reaped a fourth part more: so that no blame ought to be imputed here to the new husbandry. 6. That it is the first year of my trying this husbandry; that my ground had been but very imperfectly prepared; and that it is now in a much better condition for the next crop, though my servants have again committed several faults. All these considerations seem to me farther proofs of the excellence of the new husbandry.

“ I could prove that, in point of profit, this last field has yielded me three times as much as it used to do, in the old way, and the other field, twice as much.

“ This may more than suffice for such small experiments as mine. I could wish they had been greater, and the success more complete. With what pleasure should I offer them to you, whom I look upon as the chief and patron of all who follow the true principles of agriculture!

“ Though I have turned the bad parts of the first field I spoke of into grass; I have added three *poses* more to the arable, against next year, in order to cultivate them in the new way; which I purpose extending to all my lands the next sowing season.

“ I have, very injudiciously, I doubt, sowed between twelve and thirteen *poses* with grain which had sprouted. I do not believe that the third part of it has come up; but as I sowed thick, and my lands are much better prepared than they were last year, I hope to have at least as good a crop.”

OBSERVATIONS.

“ **W**HEN experiments have been repeated in different places, the circumstances attending them ought to be greatly considered: for if these have been alike, and the event is the same, they serve to establish one another, and merit our confidence in them. The comparison of the last experiments, with mine, gives me room to make two important observations. The first is, that both of us have perceived,

ceived, and for the same reasons, the necessity of sowing a greater quantity of seed, than we did in our first experiments. This augmentation produced better crops. We may therefore now lay down, as a rule founded on experience, that the quantity of the seed must be what we said in our last memoirs, regard being had to the particular considerations mentioned therein.

"The second observation is, that both of us have sowed beds with two turns of the drill-plough, that is, with six rows of corn, and the event in both cases has been, that the same extent of ground has always produced a greater quantity of grain. It is therefore probable that this method will be found to be the best.

"But as it is possible that the effect may not be the same in different countries, a trial may be made by sowing some beds with three rows, and others with six, and which ever answers best, may afterwards be practised.

"These two observations will be confirmed by some experiments which we shall give in the fifth article.

"Other business prevented this lover of agriculture from following his experiments in 1756, with the same attention as before. The exact, tho' short account which we shall give of them, may serve for a sequel to what we have been able to collect in relation to those he made in 1755.

Y E A R 1756.

"I N the first place, the field of six *poses*, or 5400 perches which bore a crop in 1754, and another in 1755, and which had not been dunged at all since the year 1749, being surrounded by a greater piece of land, which is sowed, sometimes with wheat, and sometimes with artificial grasses, was plowed in August, immediately after harvest, and sowed with *sain-foin*. The crop of 1756 was very fine, each *pose* yielding from 25 to 30 hundred weight of hay, at the first mowing, and half as much at the second. *Therefore the new husbandry preserved the ground in good condition, without the help of dung; and its productions do not seem to have exhausted the soil.*

"The field of about five *poses*, or 4200 perches, sowed with wheat, and which produced 92 measures of that grain in 1755, produced but 61 in 1756. The inferiority of this crop must be ascribed, 1. To the error of sowing wheat that had sprouted, which, in the opinion of all judges, occasioned a diminution of at least one fourth :

M m 2

2. To

2. To the damage done by cattle, (this field lying quite open to them,) which was greater this year than it had ever been before; part of the green corn being eaten down twice: this loss is valued at a tenth part of the crop independent of the tythe. 3. That the ears were not so full of grain this year, in this country, as they had used to be: there was as much straw, within seven trusses and a half, as in 1755; but the corn ran less into grain, tho' it still had more than the common wheat.

"Upon the whole, all losses and accidents deducted, the crop was worth double what the land would have let for.

"This field is now under wheat, which looks extremely fine, except one *pose*, which must be sowed again with something else on account of the damage the cattle have done it. The owner of this field intends to continue sowing it without dung, as long as any heart remains in it; in order, says he, to confirm myself in what I now think; or to find out my error, if I am mistaken.

"Another field of betwixt nine and ten *poses*, or about 9500 perches, produced 160 measures of wheat; but some loads of dung had been laid upon it. However, even the places which had not been dunged, produced much stronger straw than they did the year before, in which they were sown by hand. 'Tis true that the dung made the straw stronger, but the ears did not yield either more, or finer grain. This was likewise sowed with sprouted corn: but the seed was better this year, and accordingly there is a prospect of a greater crop.

ARTICLE II.

Experiments made on lands sown in equally distant rows with the drill-plough; with some reflections on the advantages of this practice.

EXPERIMENT, No. XVII.

"A Large extent of land, near Geneva, continued to be sown with the drill plough, in equally distant rows. I could instance the products of a multitude of experiments, to prove that the fields sowed in this manner, have always produced much greater crops than those which have been sown in the common way.

"I shall mention only a few experiments this year: but they are such as have been made on large tracts of ground, and consequently

are

are more decisive than small ones, of which we have already given a sufficient number in the foregoing journals.

"I shall call this No. XVII, because it was made by the same person and in the same places, as that which is marked No. XVII in the year 1754, (p. 215.) I need not repeat what I then said of the situation and quality of the lands.

"This experiment contains the products of three different farms. About 70 acres were cultivated in the first, 34 in the second, and 26 in the third: in all, 130 arpents, which were sown with wheat in September and October.

YEAR 1755.

"Quantity of seed generally used in the old way.	{	First farm	16002 lb.
		Second farm	7560 lb.
		Third farm	5922 lb.
		Total	29484 lb.

"Quantity of seed used with the drill-plough.	{	First farm	7812 lb.
		Second farm	3276 lb.
		Third farm	3150 lb.
		Total	14238 lb.

"Saved in the feed.	15246 lb.
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"Crops of 1755.	{	First farm	80210 lb.
		Second farm	27690 lb.
		Third farm	27040 lb.

"Total of the crops.	134940 lb.
"To which if we add the saving in the feed, viz.	15246 lb.
"The whole produce will be	150186 lb.

"I shall now examine what these three farms would have produced, if they had been cultivated in the old way, supposing their crops to have been equal to those of 1754; which is much in favour of the old husbandry.

"I

"I find that these three farms, which contain about 130 acres, and which would have required 29484 pounds of seed, would have produced at most from 75000 to 80000 pounds of wheat; which is 54940 pounds less than what was reaped in the new way. The following calculation of the real and effective products in both ways, deducting from each the necessary quantity of seed, will shew the advantage of the new husbandry in a yet stronger light.

NEW HUSBANDRY.

Total produce	134940 lb.
To be deducted for the seed	14238 lb.
Neat produce	<u>120702 lb.</u>

OLD HUSBANDRY.

Total produce	80000 lb.
To be deducted for the seed	29484 lb.
Neat produce	<u>50516 lb.</u>
Consequently the balance in favour of the new husbandry is	<u>70186 lb.</u>

"This may perhaps seem surprising to many: but my calculation may be the more safely depended on, as I have favoured the old husbandry greatly in my estimate of the crops in that way, and have made no deduction for the loss by sifting, winnowing, &c. which, even in the very best years, is always considerably greater in the old husbandry, than in the new.

YEAR 1756.

"THE same farms continued to be sown with the drill-plough. I shall therefore repeat the same calculation, to shew the constant advantage of the new husbandry, which is so much the more remarkable this year, as the corn in the common way yielded but very bad crops. The fields in general produced but few sheaves, and

and the sheaves very little grain, and even that was very poor in many places.

"About 90 acres were cultivated in the first farm, for the crop of this year; in the second 34, and in the third 45: in all 169 acres, which were sown with wheat in September and October. About twenty acres had been dunged.

"Quantity of seed generally used in the old way.	{	First farm	20160 lb.
		Second farm	7560 lb.
		Third farm	10080 lb.
		In all	37800 lb.

"Quantity of seed used with the drill-plough.	{	First farm	9828 lb.
		Second farm	3654 lb.
		Third farm	5040 lb.
		In all	18522 lb.
"Saved in the seed.			19278 lb.
			37800 lb.

“Crops of 1756.	{	First farm.	79560 lb.
		Second farm.	19110 lb.
		Third farm.	31590 lb.
“ Total of the crops			130260 lb.
“ To which if we add the saving in the feed, viz.			19278 lb.
“ The whole produce will be			149538 lb.

"This farm did not produce so much corn as it should have done, because near a third part of the fields was almost totally ruined by inundations.

"Supposing this accident not to have happened, what might these fields have produced? If they had been sown in the common way, these same fields would have yielded less grain than in the two preceding years. I have estimated it at somewhat less than that, and the advantage is still in favour of the new husbandry. These three farms would have produced at most from 88000 to 93000 pounds

of wheat; and according to this estimation, which I think a great allowance, the whole crop would be 37260 pounds less than it was.

"To see the exact result, let us continue our calculations, deducting the grain that was used for seed.

NEW HUSBANDRY.

Total produce	130260 lb.
To be deducted for the seed	18522 lb.
Neat produce	<u>111738 lb.</u>

OLD HUSBANDRY.

Total produce	93000 lb.
To be deducted for the seed	37800 lb.
Neat produce	<u>55200 lb.</u>

Consequently the balance in favour of the new husbandry is	} 75060 lb.
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"All these calculations prove, year after year, the advantage of using the drill-plough. To shew how great that advantage is, I shall briefly recapitulate what is most essential in this article.

RECAPITULATION.

"WE have seen a very considerable experiment repeated three years running, and always attended with great success. I shall now sum up the essential and decisive facts, which are so many unexceptionable witnesses, who depose, *That it is much more profitable to sow lands with the drill-plough, than to sow them in the common way.*

"To this end, I resume the neat products of the crops.

NEW

NEW HUSBANDRY.

Neat PRODUCE of the three FARMS.

		Pounds.
In 1754.	(p. 217.)	93418
1755.	(p. 270.)	120702
1756.	(p. 272.)	111738
Total neat produce of three years		325858

OLD HUSBANDRY.

		Pounds.
In 1754.	(p. 217.)	62200
1755.	(p. 270.)	50516
1756.	(p. 272.)	55200
Total neat produce of three years		167916

“ The difference in favour of the new husbandry, }
in three years, amounts to 157942

“ This is an object of great importance, not only to the public, whose welfare it highly concerns, but to every owner of land. How strongly does it shew the vast advantage of the drill husbandry! We here see 169 acres of land produce 157942 pounds of wheat more than they would have done without this favourable culture.

“ Any one may easily reckon the value of such a quantity of wheat, supposing it to be of the very best sort, as in fact it was.*

EXPERIMENT, No. XVIII.

“ I Shall now give a short account of the success of another farm, which I have hitherto sowed in equally distant rows, with the drill-plough. I generally sow about 23 or 24 acres of it every year. For the crop of 1755, I used 1840 pounds of seed corn, which produced 10400 pounds of grain. For the crop of 1756, I sowed 2772 pounds of wheat, the produce of which was

N n 14560

* Reckoning the English bushel at 62 pounds, these 157942 pounds will exceed 320 quarters of wheat.

14560 pounds, which is a great deal, considering the quality of the land.

"I shall conclude this article with a short detail of two little experiments made by the person I last spoke of on two fields of different soils. The first, which contained about two acres, was of a light soil, and somewhat stony. The quantity of seed generally used for that ground, was about 380 pound weight. It was sowed very thick, with the drill-plough, and took up 252 pounds of seed. I attended carefully to the progress of this corn. It ripen'd well, the straw was very long, and crowned with fine ears which yielded 2835 pounds of grain.

"The second experiment was made on a stiff soil. Half the field was sown in the common way; and the other half in equally distant rows with the drill-plough, and only two-thirds of the usual quantity of seed was used. This last half yielded double what the other did, though it was sown with a third less seed.

ARTICLE III.

"THE design of this article is, to shew that lands which are laid out in beds according to the new husbandry, produce more corn than those which are only sown in equally distant rows, with the drill-plough. The proof of this proposition will result from proper calculations, and a comparison of the products of these two different methods.

"It is of no small importance to the public, to know exactly which is the best and most profitable way to cultivate land. This article deserves still more attention than the last, as it tends to point out the means that are in reality most advantageous, tho' opposed by an obstinate attachment to the old husbandry, and the extreme reluctance with which farmers can ever be induced to try a new practice, which they are almost always ready to condemn without taking the pains to know what it is, and indeed, generally, because they are not able to judge of it. It cannot therefore be expected, that the theory alone should satisfy them that this husbandry is consistent with the best principles of agriculture. If any thing can convince them, it will be a series of facts, and experiments repeated during a course of years, always successfully in so many different places.

"It is highly necessary to dwell upon the proofs that the old husbandry

bandry is less profitable than the new, in which the field intended to be sown is first laid out in beds: for, after showing that lands so laid out and sown, produce considerably more than those which are sown only in equally distant rows, with the drill-plough, as has been demonstrated in the foregoing article; and likewise, that these last produce considerably more than they used to do in the old husbandry; the superiority of the crops which the beds afford, will certainly appear still more striking, and no doubt will remain of the excellence of the new culture.

To this end we shall compare the neat produce of the three farms mentioned in the foregoing article, this year 1756, with that of the fields which I have laid out in beds.

In consequence of the general opinion, that dung, or any other kind of manure, contributes greatly to fertilize land, and makes it produce more than it would otherwise; It is to be observed in the first place, that part of the land of the three farms was dunged, and that my fields, cultivated in beds, had not had any dung or other manure for many years.

Secondly, that the lands of the three farms are always fallowed every second year; whereas my fields have been sowed every year since they first began to be cultivated in the new way, and have already borne several successive crops.

Thirdly, it should be considered, that the year 1756 was extremely rainy: a circumstance by no means favourable to strong stiff soils, like mine; and at the same time rather beneficial than hurtful to the three farms; a great part of which is light land, which requires frequent rain.

Lastly, the reader will remember, that about a third part of the second farm was overflowed, whereby the crop was diminished: but on the other hand, I think this damage is pretty nearly compensated by the accidents which happened to my field, (experiment No. IV. p. 252.) which certainly lessened the crop considerably.

These reflections seemed to me necessary, in order to give a just idea of the comparison I am going to make, which, I believe, will be sufficient to prove what I purposed to shew.

Comparison of the produce of land sown in equally distant rows with the drill-plough, with that of other land laid out in beds.

"The neat produce of the three farms, containing about 169 acres, which were sown in equally distant rows with the drill-plough, was, after deducting the seed,

Of the {	First Farm	Pounds.
	Second Farm	69732
	Third Farm	15456
Total neat produce		26550
		111738

"Neat produce, after deducting the seed, of the fields laid out en beds, and sown with the drill-plough; with the number of each experiment, and the measure of each field.

Experiment, No. 2.	P. 245.	1½ acre	Pounds.
4.	252.	15	1834
5.	253.	7½	2824
6.	254.	2½	2156
7.	256.	15	627
8.	256.	1	5759
9.	258.	6	1850
10.	259.	6	1924
In all 54 acres.			2352
Total neat produce in 1756			19317

"After the beds are once formed, the same fields are sown every year: consequently these will produce another crop in 1757, which, supposing it to be only equal to the last, tho' there is great reason to think it will be much better, will again be

"Fifty-four acres will then produce neat, in two years,

38634

"The

"The 169 acres of the three farms sown in equally distant rows with the drill-plough, will produce nothing in 1757, that being their year of fallow; consequently their neat produce in two years, will have been only 111738 pounds of wheat, whilst the 54 acres made into beds, will have produced 38634 pounds. But supposing the 169 acres to have been cultivated in beds, and their produce to have been in the same proportion as that of the 54 acres, it would amount to 134769 pounds, which is 23031 pounds more than they produced when sown in equally distant rows with the drill. This difference ought never to be forgot.

"The new method of laying the land out in beds, has still greater advantages than this. Our comparison has been only of the neat produce of 169 acres which were sown the same year in the three farms: but it is to be observed, that these farms consisted of 169 acres more, which were under fallow for the next year's crop. The neat produce of the crops of those 338 acres in the two years of sowing them in equally distant rows with the drill-plough, supposing both crops to be equal, would be.

	Pounds.
For the first year, 169 acres,	111738
For the second year, for the 169 other acres,	111738
For the two years	<u>223476</u>

"If these 338 acres were laid out in beds, they would be sown each year, and their neat produce, supposing both years alike would be,

	Pounds.
For the first year, 338 acres	134769
For the second year, 338 acres	134769
For the two years	<u>269538</u>

"So that this calculation proves plainly, that the 338 acres will produce 46062 pounds of wheat more when cultivated in beds, than when sown in equally distant rows with the drill-plough: a difference which, in ten years, will amount to 230310 pounds of grain.

As great as this advantage is in favour of the beds, it will appear very small when compared to that which the culture in beds has over the old husbandry; as the following calculation will shew.

Let us first settle what would have been the neat produce (by which we always mean that which remains after deducting the seed) of the 169 acres of the three farms, for one year; and afterwards that of the other 169 acres the next year, supposing both crops to be equal.

"We have already seen that the produce of 169 acres would, at most, not have exceeded 55200 pounds of wheat, in 1756. But as that was a bad year, I will make the following comparison on the footing of a good crop, in order to give the old husbandry every advantage that can possibly be desired. I will therefore suppose the neat produce of 169 acres to have been the first year 76000 lb. and that of the other 169 acres, the next year 76000 lb.

For the two years	152000 lb.
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"We have seen that the same 338 acres cultivated in beds, reckoning their neat produce for two years only on the footing of the bad crop of 1756, would have yielded 269538 pounds of wheat: consequently this culture would have produced in two years 117538 pounds of corn more than the old husbandry; and this difference, in ten years, would amount to 587690 pounds.

"The great advantage of the new husbandry, in general, and that of laying the ground into beds, in particular, is, I think, now fully proved. The difference is great indeed: but I believe it will be still much greater hereafter, when the yearly observations of the followers of this new way, whose number increases daily, shall have brought this culture to a greater degree of perfection, which I hope will in some measure be the case next harvest."

C H A P,

tailw bands, none of which are given to even the best of the family.

C H A P. III.

*Of the Culture of MAIZ, or INDIAN CORN, by M. AIMEN, M. D.
at Bourdeaux.*

THE land which is intended to be planted with Maiz, ought to receive two good plowings in March. It is proper to observe, that this plant thrives better in a light and sandy soil, than in a stiff and clayey one; and that it cannot do without dung.

Towards the end of April, the furrows are made by giving the ground a third plowing; after which the clods are broken by hand, because the furrows prevent using a harrow.

A fair day is chosen in May, to sow the maiz, which is done by making small holes with a stick or other instrument, at the bottom of the furrows, into which two grains of maiz are dropt.

Care is taken to make the furrows, or trenches, a foot and an half asunder, and the holes in those furrows at the same distance from each other, in such a manner that they form a kind of quincunx.

When the maiz is come up, the weakest of the two plants is plucked up wherever both grains have sprung, and two new grains are planted where neither of them have grown.

Towards the 15th of June, the earth is hand-hoed round each plant; and as they stand in the bottom of a furrow, the mould which crumbles down from time to time, lays fresh earth to their roots, and helps to support them.

Towards the end of July, a slight hoeing is given them, which is the last; and in so doing the earth is laid towards the roots of the plants.

On the 15th of August, the panicles of the male flowers are cut off. It is well known that these contain no grain, and that they grow at the top of each plant. Care must be taken that the grain be impregnated before they are cut off, which may be known by the outward covering of the ears appearing turgid. The panicles must not be cut off from all the plants at the same time, because some of the ears are a fortnight later than others, before they are impregnated. These panicles are excellent fodder for cattle.

Nearly about the same time, all the leaves are stripp'd off the stalks, together with all the blighted and smutty ears: for it is pretended that if they should be left upon the stalks, the good ears would not grow so big, nor the grains be so well nourished.

All

All these leaves and ears are given as fodder to oxen; and what is remarkable is, that those creatures are fonder of the smutty ears, than of all the rest.

The time for reaping maiz is towards the end of September: the ears are then gathered by hand, and put into baskets, in which they are carried and laid in heaps from space to space in the field; after which they are loaded in carts, carried home, and spread upon an even floor prepared for that purpose. They are then taken out of their sheath or hood, and dried in the sun before they are laid up in the granary; or else the grain is taken out at that time.

There are two ways of taking out the grain. The first is, by threshing it with a flail: this method is the most expeditious; but it breaks and bruises much of the corn. The second, which is most used, is, by rubbing the ears hard against the edge of a flat piece of iron: this easily separates the grains from the husks, without hurting them. These husks are good food for oxen.

As soon as the ears are gathered, the stalks remaining in the ground are plucked up, and laid by for winter fodder for oxen. The field is afterwards plowed up as soon as possible: it being the general opinion of farmers that the roots of the maiz would otherwise continue to suck up the rich particles of the earth. Whether this be true or not, their notion is, that if this plowing should be deferred, the next year's crop would certainly suffer by it: which is highly probable, because the winter plowing is very beneficial to the next crop.

When the maiz has been well dried in the sun, it will keep several years, and not be the less fit for sowing. It keeps better in grain, than in the ear.

It has been observed, that the weevil is much more apt to attack the grains of maiz while they are left in the ear, than when they are separated from it. Perhaps the sweet juice of the stalk may attract them, more than the grain itself.

Lastly, the grain is laid up in a dry granary, and care is taken to turn it every three months; which prevents its growing musty, or being attacked by insects.

In many places, the country people mix a certain quantity of this corn with the wheat or rye of which they make their bread. Far from hurting, it gives it a savoury taste. The general proportion is, an eighth part, and sometimes more, of this corn, to seven parts of wheat.

Bread.

Bread made of the flour of maize alone, is yellow, and it is heavy, and hard to be digested, because the dough ferments very little, if at all. However, many of the peasants in Guyenne fed upon it for whole years without finding any inconvenience from it; particularly in 1738, when all the corn of that province was destroyed by hail; and in 1748, during the great scarcity of corn. They likewise made a kind of hasty-pudding with the flour of maize, which is well tasted enough, but sits heavy upon the stomach.

Maize is also of great use to fatten poultry and hogs. It is given whole to the larger kind of fowls, and broken a little to others.

When maize is planted for fodder, particularly of cows and oxen, it is in a good soil, which is plowed twice, and well dunged; after which the grain is sowed and harrowed in, or covered with a rake.

Maize is a great impoverisher of land: for though the ground be dunged every time it is planted with this grain, it has been observed that wheat never does so well in the furrows where maize has grown, as in the neighbouring fields where it never was.

M. Aimen has observed, 1. That it is important to sow maize, rather in the beginning, than at the end of May; because, if it is sowed early, the plants will have acquired sufficient strength before the great heats, to shoot out then with vigour: and their ears will not be parched, or liable to that barrenness to which maize sowed too late is subject: and not only their stalks will be stronger, but their ears will be bigger and fuller of grain: 2. That the ears of the maize are greatly hurt by cutting the panicles too late; and that they ought to be cut before the hoods open. By leaving a plant with its male ears at every twenty feet distance, all the female plants will be impregnated.

For two years together, M. Aimen singled out two rows of maize, the plants of which seemed to him equally strong. He cut off the panicles of the male flowers of all the plants in the first row, before their hoods opened: the panicles of the other row were not cut off till the usual time of performing that operation; the consequence was, that the female ears of the first row were much the largest and best filled with grain.

M. Aimen sowed a row of maize at a distance from any other field planted with that corn. He cut off the panicles of that row, before the hoods were opened, leaving only one plant with its male flowers at every twenty feet distance. At harvest, he observed,

O o

1. That

1. That all the female ears of all the plants were impregnated :
 2. That the female ears of the plants which had lost their male panicles early, were thicker, longer, and fuller of corn, than any others : 3. That the female ears of the plants whose panicles had been cut late, were smaller and shorter, and that in some parts of them the grains were abortive.

It would be right to try the culture of maiz with the cultivator, of which we shall give a description hereafter. To that end, it would be proper to plant the rows two feet asunder, and the grains in those rows twelve or fourteen inches distant from one another. All the necessary hoeings might then be given with the cultivator drawn by one horse. M. Aimen believes the maiz would thrive the better for it, and that the land would afterwards be fitter for other grain. It is worth the while of those who live in countries where maiz is cultivated, to try what this will do.

Great quantities of maiz and millet are raised in Guyenne. What M. Aimen says of the culture of this last plant, we shall defer mentioning, till we come to treat expressly of it in the next part of this work, and continue here his observations upon maiz.

Custom, says he, has taught our farmers to keep their plants of maiz about a foot and a half distant from each other if they would have a good crop. In order to know whether it was absolutely necessary to leave so great a distance, he made the following experiments.

In April 1763, he prepared six beds like those of the former experiments. Three of them, which we shall speak of hereafter, were sown with millet, on the 1st of May. The other three were sown with maiz, on the third of that month. The first was sowed after the usual manner of the country, with one ounce and one pennyweight of seed : the second was sowed with two ounces and two pennyweights, the grains being only a foot asunder : and a third, in which they were but six inches apart, was sowed with four ounces and a half.

The first of these beds produced 18 pounds and four ounces : the second, 15 pounds 7 ounces, and the third 11 pounds two ounces.

Maiz is sometimes sowed very thick, when it is intended only for fodder. In that case, all the female flowers are barren, and produce no grain.

This experiment, says M. Duhamel, proves that some kinds of

of grain will not do well, unless they are sown very thin: "I am persuaded, adds he, that for want of this precaution, "a great deal of grain is often lost, and the crops are considerably diminished.

We are favour'd with the following account of the culture of maize in North-America, by a very worthy and ingenious gentleman of that country.

"The English, says he, in North-America, plow the ground "thoroughly before the grain is planted. They seldom, if ever, dung "the whole face of the field, but sometimes put a little dung in each "hill of corn, if they think the ground requires it. Where fish "are plenty, in the planting season, they put two or three small "fish into each hill, with the grain.

"In order to plant the corn, they make trenches or furrows, "with the plough, across the field, at certain distances from each "other, and cross these with others of the same distance, which "divide the field into squares; and where the trenches intersect, "the grain is put in, and covered. Three or four grains are com- "monly planted for each hill. The intermediate ground is after- "wards plowed at leisure, as the plants grow, and want more loose "earth for the roots to spread in. The hills are made at the time "of weeding, some loose earth being then hoed up over the roots, "and round the stems or stalks of the corn.

"The corn is planted at different distances in different places. "In the northern colonies, the Indian corn grows low, seldom ex- "ceeding four or five feet in height: and the leaves being propor- "tionably small, the plants do not require so much ground as in "the southern colonies, where they frequently rise to fourteen or "fifteen feet. The space generally allowed for the lowest plants, "is three feet, and for the highest, five or six. This distance may "be more necessary in our manner of cultivating this corn; more "ground being required to nourish three or four plants, than one; "for I do not know that we ever pluck up any of the plants. "An advantage attending this method is, that the labour is less "in hilling; three or four plants being earthed up in the same time "as one: and there is more room for passing between the rows "when the corn is to be weeded.

"At the same time that the corn is weeded, the ground is loosened "round the plants, with a hoe, and the hills are raised and enlarged "from time to time, by adding more earth. The morning, before

" the dew is off, and the evening, are reckoned better for this work than the middle of the day.

" The hilling of the corn, as it grows, has been the universal practice: the design being to give the plant more nourishment, and to support it better against the winds: but of late, some planters have thought it better to plant in holes: the reason is, that this plant requires a good deal of moisture: and indeed, nature, by the form and position of the leaf, appears to have intended the receiving of the rain that falls around, and conducting it to the stalk, and by that, down to the roots: but a hill round the stalk, tends to throw the water off to a greater distance: and as to supporting the plants, they say the hills do not effect it; because, by covering the stalks, in that part, from the air and sun, which would harden and strengthen them, the mould around them keeps them soft and tender, and thereby rather weakens them*.

" The panicles, or toffils, contain the *farina fecundans* of the plants, and therefore should not be cut off, till the grain in the ear is filled. If the toffils of a whole field should be cut off before that time, there would be no grain at all in the ears. This has been proved by experiment.

" In the more southern colonies, where hay is scarce and the leaves of this corn are very large, they cut them off for fodder: but in the northern colonies, where there is plenty of hay, and the leaves of the corn are small, they generally neglect cutting off the toffils, and stripping off the leaves. These are left on the stalks, and the cattle, being turned into the fields, after the corn is gathered in, eat what they like of them: but they are not esteemed so good as what has been cut in season.

" An easy way of taking the grain out of the ears, is, to rub one against another, holding one in each hand.

" When the ears are stript of their husks, they are reckoned in the best state for preservation; much better than when the grain is

* It must be of great advantage to strong quick growing plants, like Indian corn, to have a loose deep mould to grow in. We therefore think that the new husbandry must be singularly useful in the culture of it: for stirring the ground with the cultivator or horse-hoe, will keep it in a loose state; and M. de Chateau-vieux's cultivator with mould boards, is very well adapted to raise the earth into hills about the plants, as it goes across the field, in the manner they hoe the ground in their usual way: and as this cultivator leaves a large furrow in the middle between each hill, the farmer will thereby have an opportunity of loosening the earth to a great depth.

rubbed

"rubbed off from the ear: for then, they say, insects can get at the
"soft part of the grain, and eat into it, which they cannot do,
"while the soft part is connected with the cob in the ear, and the
"hard flinty part of every grain turned outward, and the grains
"close to each other.

"To preserve their corn, they make in North-America, a sort
"of bins, or cages, which they call corn-cribs, fifteen or sixteen
"feet long, and five or six feet wide, widening upwards to the top
"a foot or more. They are made of sapling poles, three or four
"inches diameter, framed roughly together, by notching the ends
"where they cross the corners, at such a distance from each other,
"as but just to keep the ears from falling through, that there may
"be a free passage for the air. These bins stand abroad, and
"have a slight moveable covering, or thatch, to keep out the rain.
"The Indians bury their corn in holes in the ground, lined with
"mats and dry leaves.

"The manner of using this corn in America, is various. It has
"this advantage over wheat, that subsistence may be drawn from your
"corn fields long before the general harvest: for the green ears
"roasted are delicate food; and as the corn ripens and grows harder,
"the ears boil'd are good eating, with butter and salt. When it is
"ripe, the corn parch'd and ground into meal, is the hunting and
"war provision of the Indians; being light to carry, and affording
"good nourishment. They mix a little of it with water, and it
"needs no other cooking, having already passed the fire in the parch-
"ing. The grain soaked in water, will part with its skin when beat
"in a large mortar with a wooden pestle: then it is boiled and eaten
"with milk. Being pounded coarsely, dry, it is also boil'd and
"eaten as rice. Bag puddings, and baked pudding made of it pro-
"perly, are very good. The meal is also boil'd with water, to
"make what they call a hasty pudding, which they eat with butter
"and sugar, or with milk. This hasty pudding, or boil'd meal,
"being mix'd with twice as much dry wheat flour, and worked into
"loaves, makes much better and pleasanter bread than flour alone.
"All creatures fed with Indian corn, have firm fat and flesh: the
"pork of corn-fed hogs is reckoned the finest in the world for taste
"and goodness: their fat is milk-white; and as hard as butter. The
"horses of Virginia and Maryland, whose chief fodder is the leaves
"and stalks of this corn, are reckoned the hardiest of the species,
"bearing most labour, and requiring least care. The people in the
countries

"countries where most of it is eaten, are healthy, strong and hardy, and generally well grown and well-looking; except only where, from the neighbourhood of marshes or stagnant waters, the air they breathe is unwholesome."

We have the pleasure to acquaint the reader, that, since the publication of the former edition of this work, we have been informed, that a gentleman in Lincolnshire planted some acres of ground with maize, which ripened perfectly well.

CHAP. IV.

Experiments on Smyrna wheat.

Smyrna wheat has a very large ear, with several lefs, or collateral ears, growing out of, or round this large one. It requires a great deal more nourishment than the common husbandry will afford; for there its ears grows very little bigger, and produce little, if any, more grain than those of common wheat. In all probability, it will do much better when cultivated according to the new method: but the experiments which have hitherto come to our knowledge are very few. The following is the chief, and indeed the only one worth mentioning.

M. Le Vayer, one of the masters of the court of requests, sowed some of this wheat in 1751, in a small part of his estate at Duviere, in the province of Maine, and had a very good crop. He sowed it again in 1752, in the common way; and though it did not answer near so well this time, it yielded him a third more than common wheat would have done.

In order to try how this wheat can be cultivated to the best advantage, M. Le Vayer sowed seven pounds and an half of it, in November 1752, in two pieces of ground which had formerly been a kitchen garden, and of which the soil was good and deep. It came up well, and the plants were very fine till July, when heavy rains fell, which laid them quite flat. The great heats which came on immediately after, raised them but very imperfectly. However, notwithstanding all this, the grain filled and ripened perfectly: but, tho' the year was very forward and extremely hot, this corn could not be reaped till

* Count de la Galiffoniere, says M. Duhamel, sowed some of it for several years: it produced a little more grain than common wheat; but the bread that was made of it, was not so good.

near

near three weeks after the common wheat. It produced thirty one sheaves, which yielded 420 pounds of grain; that is to say, 56 for one. If this ground had been sown according to the common method of the country, it would have taken up fifty pound weight of seed; and, good as the soil was, its produce would not have been more, even in the best of years, according to the general run of the crops of this country.

"The result of this experiment," says M. le Vayer, "seems to contradict the theory of the new husbandry, which promises that the stalks of wheat cultivated in the new way, being less crowded, and more exposed to the air, will be stronger and less apt to be lodged, than that which is sowed in the common way. It is likewise to be observed, that the common wheat, sowed according to the old method, was not lodged at all this year, but kept quite upright, tho' it sustained the same rain as the other. The bigness of the ears of the Smyrna wheat, which makes them the more apt to retain wet, may have occasioned this difference. However, M. du Verger, who, the same autumn, and last spring, sowed common wheat, spring corn, and barley, in rows, found that neither of these grains ripened till long after those of the same species sown in the common way, and that all of them were lodged. That excepted, his crop was good. But if the same accident should happen every year, it might be feared that the grain would not be able to ripen thoroughly, and especially in cold wet years. This is, perhaps, an inconvenience in the new husbandry, to which cold countries may be more liable, than those that are warmer."

This, as M. Duhamel observes, cannot be known, but by a series of experiments: for, adds he, we see that the corn sown in the new way, has been reaped, in many places, almost as early as any other, when care has been taken to sow it sooner. It has been prevented from lodging, by turning the earth of the alleys over towards the rows.

M. du Verger, who lives at Mans, having communicated his experiments to M. Duhamel, this last observes, that they were made on very small spots of ground, from which no conclusion can be drawn; because the borders of a field are almost as favourably situated as the beds in the new husbandry, the roots of the plants there being able to extend themselves to seek their food: this is the reason why the plants near the foot paths in corn fields are always the finest: now it is very plain that the outside borders of a very small spot of ground are

are a considerable part, in comparison of the whole; and therefore its produce cannot be justly compared with that of another small spot sowed in rows.

CHAP. V.

Experiments made on wheat of different countries.

IT would be wrong, says M. Duhamel, to suspect us of having no other view, than merely to extol the new husbandry. The only reason that induces us to dwell so much upon it, is, that we think it may be extremely profitable in some cases, and very useful in others. Whatever is capable of promoting the progress of agriculture, is equally interesting to us. With this view, we applied to the factors of our East-India company, for samples of the different kinds of wheat of the countries where they reside. They were sent to M. de Reaumur, who was so kind as to deliver them to me. I shall say, in a moment, what use I made of them. The late marquis de la Galissoniere had before given a pretty large quantity of a wheat which he had brought from Spain, and which he knew made the best bread of any in Europe. At the same time, the marquis de Gouvernet gave me a sample of a large grain'd spring wheat, which was said to multiply exceedingly.

I was the more pleased with having these samples, as I am persuaded that many of the different kinds of wheat which are generally cultivated in most countries, may, by reason of the soil or other physical causes, not be so fit as some other kinds may be, to produce the most plentiful crops, or make the finest bread. Few countries, or indeed few countries, cultivate more than two or three kinds of wheat; and the generality of farmers have so little curiosity, that they do not so much as think of trying whether any of the sorts that are cultivated in other places, would not be preferable to those they use.

An attentive traveller may observe that the wheat which grows in the different countries he goes through, is not all alike: but he contents himself with making this observation in general, without considering that he would do his own country, an essential service, by bringing into it a better kind of wheat. 'Tis true, this might perhaps be attended with some little trouble: to avoid which, most people are very ready to persuade themselves that those more perfect kinds of wheat would not answer in any other soil

than

than their own, or that they would soon degenerate in it. For my part, I am thoroughly satisfied, that improvements of this kind, ought by no means to be looked upon as objects of small importance, and that it is right to try the culture of different kinds of grain, in hopes of meeting with some which may deserve the preference to that which it is the custom to sow. Doubtless, many might not succeed. Accordingly, I was not at all surprized at the poor condition to which the wheat I received from Suratte and Bengal, and which I sowed in autumn and in the spring, was reduced. Those climates are so different from ours, that I could not well expect any better success.

The Spanish wheat, which M. de la Galiffoniere gave me, and which I sowed in autumn, rose well; and the winter being very mild, it made a fine appearance till near Whitsuntide: but then, it dwindled away on a sudden, and afforded scarce any crop at harvest. The case was different with some of the same wheat which I sowed in March. Notwithstanding the too frequent rains, which hurt every other kind of wheat, this was equal to the very finest corn, and yielded an excellent grain, as hard, and transparent, as if it had grown in Spain. The whole produce of this crop is set apart, to be sowed next spring. This same corn was tried, with exactly the same success, at Digny, and at Denainvilliers.

The spring wheat which I had from M. de Gouvernet, suffered more from the intemperature of the seasons, than the Spanish wheat. Its grain was shrivelled. However, I kept it for next year.

I sent some of each of these kinds of wheat to M. le Vayer, who sowed them, and after harvest wrote to me as follows.

“ A pound and an half of Spanish wheat (the marquis de la Galiffoniere's) sowed in autumn, produced five pounds and an half of clean grain. This wheat was as fine as that we are going to speak of. The scantiness of the crop was owing to the birds that preyed upon it.

“ The same quantity of the same wheat, sowed in the spring, produced sixteen pounds of very clean grain.

“ Half an ounce of large grain'd spring wheat (the marquis de Gouvernet's) sowed on the 11th of October, produced only two ounces and an half of bad grain.

“ Another half ounce sowed in the spring, rose well; but not being able to bear the almost continual rains, it produced nothing.

"Two ounces of Suratte wheat sowed in October, produced but three penny-weights of a very light and meagre grain.

"Two ounces of the same wheat sowed in March, rose well, but bore no ears.

"Two ounces of Bengal wheat sowed in October, produced twenty ounces of pretty fine grain.

"Two ounces of the same wheat sowed in March, produced but three ounces."

It is to be observed, that the soil in which these different grains were sown, though good, is clayey. M. le Vayer chose it on purpose; not only because it was new ground, but likewise because its exposition was due South, and it was sheltered on the north side by a high wall. All this seemed very proper for a grain which came from so very hot a country: and perhaps it might be owing to this precaution, that the Bengal wheat succeeded better with M. le Vayer, than at Denainvilliers.

The Suratte wheat, which is reaped in the Isle of Bourbon four months after it is sowed, did not ripen with M. le Vayer till eight or ten days before the common wheat, tho' it was sowed in autumn. It is not to be doubted, but that if the summer had been warm and dry, these grains would have succeeded better, and especially that which was sowed in the spring: and probably that which was sowed in autumn, would have perished in the winter, if that season had not been extremely mild.



PRACTICAL TREATISE
OF
HUSBANDRY.

PART III.
Of the Culture of SPRING CORN, MILLET and RICE, LEGUMI-
NOUS PLANTS and POT-HERBS, FLAX and HEMP, ARTIFICIAL
and NATURAL GRASS, and the VINE.

CHAP. I.

Experiments on BARLEY, OATS, and RYE.

SECT. I.

*Experiments made near Bourdeaux, by M. Navarre, Dean of the
Court of Aids.*



On the thirteenth of December, 1751, M. Navarre sowed four beds, two with wheat, one with rye, and the fourth with barley. The beds were 24 feet long, and, with the alleys, 6 feet wide. The grains were sown at the distance of eight inches from one another; and each bed had three rows, which were likewise eight inches asunder.

The wheat appeared long before the rye and barley, and suffered greatly by insects, which not only eat numbers of shoots two or

three inches long, close to the ground, every day, but also attacked the roots and the grain in the earth. Disgusted by this incident, he gave up this spot, concluding it would come to nothing. The rye and barley came up much later.

However, he was surprised afterwards to find several plants of wheat, some of which had upwards of 60 stalks, with long ears. The rye and barley were less damaged. The rye had, in general, from 50 to 55 tall well-eared stalks; and one of the plants of barley had 101 stalks.

What he particularly remarked was, that in all these beds, the middle row branched least and was much the weakest: whence he concluded, that it would be best to make the beds only four feet wide, and to sow but two rows in them, and those a foot asunder; an alley of three feet being sufficient to admit the summer plowings with one bullock.

M. Diancourt sowed eight perches of ground with oats, in double rows, with alleys six feet wide. Farmers, the most prejudiced against the new husbandry, acknowledge that there was more grain in one of these double rows, than in eight perches sowed in the common way.

SECT. II.

Experiments made at Avignac in Britany, by M. DE BRUE.

M. De Brue sowed with winter oats, part of a field which had been rested, but brought to a fine tilth, and was of a light soil. The severity of the cold having destroyed the oats, he plowed it up again in March, for spring oats, which were very fine. Most of the stalks were five feet high.

He left untouched a small corner, where he perceived several plants of the winter oats, which the frost had not destroyed. Though this spot had been exposed to the trampling of cattle, and promised but little from the beginning; M. de Brue was surprised at the beauty of these oats, and at the quantity they yielded. The straw was six feet high, and loaded with very fine grain. "It is true, says he, I believe I was partly indebted for this success to the dryness of the season: for the ground I am speaking of, is frequently overflowed in wet years, notwithstanding all the pains I have taken to drain it."

"In the month of August," continues this gentleman, "I plowed
" up

“ up another field which had just borne hemp, and made it into
 “ beds, ten or twelve feet wide. In the beginning of September, I
 “ sowed it with about 120 pounds of rye, which came up very
 “ thick. I mowed it three times, before it spindled, and got fifteen
 “ thousand weight of green fodder, which was of great service to
 “ my cattle, the severity of the winter having left very little grass
 “ on any pasture grounds.

“ This fodder purges and nourishes cattle. The cows that were
 “ fed with it gave plenty of milk, which made excellent butter.
 “ Many farmers, who saw what I did, intend to follow my example.
 “ I let the fourth shoots of this rye grow up to seed. The ears
 “ were very small, and yielded me nearly the quantity I had
 “ sown.

Mr. Miller mentions the practice of sowing rye for fodder, in
 some parts of England. “ Rye, says he, is sown in autumn, to
 “ afford green food for ewes and lambs in the spring, before there is
 “ plenty of grass. When this is intended, the rye should be sown
 “ early in autumn, that it may have strength to furnish an early feed.
 “ The great use of this is to supply the want of turneps in those
 “ places where they have failed; as also, after the turneps are over,
 “ and before the grass is grown enough to supply green food for the
 “ ewes: so that in those seasons, when the turneps in general fail,
 “ it is very good husbandry to sow the land with rye, especially
 “ where there are stocks of sheep, which cannot be well supported,
 “ where green food is wanting early in the spring.”

S E C T. III.

Extract of a letter from a gentleman in Poitou.

“ **B** EING persuaded of the advantages of the new method of
 cultivating land, I resolved to make a trial of it, by comparing
 “ the produce of a field cultivated in the common way, with that
 “ of another field cultivated according to the new husbandry: and
 “ as M. Duhamel has desired all lovers of agriculture to try, by
 “ experiments made with care, whether it be most profitable to sow
 “ beds, with two, or with three rows of corn; or, which is the
 “ same thing, to find at what distance the rows ought to be sown;
 “ I divided a spot of ground into ten equal parts, which I made
 “ into as many beds, each six feet wide.

“ In

" In the middle of five of these beds, I sowed three rows, seven inches asunder, so that they took up fourteen inches of ground, and there remained four feet ten inches for the breadth of the alleys, which is very sufficient for the horse-hoeing husbandry.

" I sowed three other beds with only two rows, a foot distance from each other: consequently the alleys were five feet wide.

" The two remaining beds were sown with two rows each, three feet asunder. The alleys were therefore but three feet wide: or rather, the whole of this last spot may be looked upon as sown in single rows, with alleys three feet wide, which is too narrow a space to admit of horse-hoeing them conveniently.

" Before I speak of the products of these beds, it will be proper to observe:

" 1. That this trial was made with rye. My fear that birds might eat up the wheat, made me prefer rye; which I advise every one to do, when only small experiments are made. This escaped without the least damage: whereas I have observed, that when experiments have been made with wheat, the birds, preferring that to any other grain, have always destroyed a considerable part of the crop.

" 2. The beds sown with three rows were near a hedge, which greatly damaged two of them; either by its roots exhausting the ground, or by its shadow keeping that part harder frozen than the rest.

" 3. The intervals were not hoed at all, between either the double or the triple rows: only the alleys were horse-hoed; and consequently none but the single rows were hoed on both sides.

" 4. On the twenty-fifth of February, the alleys were plowed. I visited them the second of March; and found, upon examining the plants, that in these five days, they had shot out roots four inches long into the new-stirr'd mould. I repeated the hoeings at proper times, and the rye continued in good condition 'till it was reaped. The last hoeing was given after the bloom was past.

" 5. I then examined the roots, and found they had extended eighteen inches into the loose mould. This may seem strange, but I am certain it is true, for I took every precaution not to be deceived.

" 6. The

"6. The alleys between the single rows were hoed but twice, being too narrow to admit the plough, after the plants had begun to branch. However, I had no reason to complain of the produce of these single rows.

"Having now given an account of my operations, it is time to say what the products were.

"The ears of my rows were from four to seven inches long, and the stalks from four to six feet high, which was one third higher than in the neighbouring fields, cultivated in the old way.

"This spot of ground, in the best years, never produced more than five bushels, including the bushel of seed corn; for that was the quantity generally used: in common years, it has not yielded above four bushels, and frequently much less. We therefore cannot reckon its produce, one year with another, at more than four bushels, including all faulty grains and seeds of weeds, which fall through the sieve, and remain mixed with the good grain. This year it has yielded me seven bushels of fine clean rye, considerably larger than the common sort. I make no account of the seed, the quantity was so small. To prevent this grain's being mixed with any other, and at the same time to judge more exactly of the produce of my ground, I had the sheaves threshed out close by the field: but it was in the middle of a road, where all the grains scattered by the flail could not be gathered up: by which I reckon I lost more than the amount of the seed that was sown in the rows. The produce of my little field was therefore this year, compared to other years, as seven is to four; to which must be added, that it is capable of bearing as great a crop every year, which is not the case in the common husbandry.

"Let us now examine the produce of the rows, and compare them one with another, in order to judge whether it be most profitable to sow in single, double, or triple rows.

"Two beds, the most distant from the hedge, sown with triple rows, yielded three quarters of a bushel each.

"Two beds with double rows, yielded each two thirds of a bushel: consequently the three beds with double rows yielded two bushels, and the six rows sown two and two, in three beds, yielded one quarter more than the six rows sown three and three in two beds: but two beds of three rows a-piece yielded one ninth more than two beds of only two rows a-piece: whence we
"may

“ may conclude, that the distance of the rows increases the produce
 “ of an equal number of plants; or, which comes to the same, that
 “ an equal quantity of seed will produce more grain when the rows
 “ are more distant, than when they are sown closer together. But
 “ this is not a real profit, because the six double rows take up one-
 “ third more ground than the six triple rows.

“ Each of the single rows yielded seven-eighths of a bushel, which
 “ is one-seventh more than the triple rows, tho’ they took up no
 “ more ground; and their produce would probably have been
 “ greater, if they had been hoed two or three times more.

“ It appears by this account, that the profit would probably have
 “ been on the side of the double rows, if the alleys had been made
 “ only four feet wide, instead of five: for by this means I should
 “ have gained one-fifth more ground, and four feet are a sufficient
 “ width for the operations of the horse-hoe. Where the single
 “ rows are so near as in this experiment, the same ground would
 “ scarcely bear another crop the next year, for want of having been
 “ sufficiently stirred. To clear up this point by a new experiment, I
 “ have sown single rows in the middle of four beds, two of which are
 “ four feet wide, and the two others only three. The winter hoe-
 “ ings have been given them with ease, and I hope the others will
 “ not be more difficult; at least till all the corn is spindled. What
 “ I fear most is, the earth’s being carried off the narrow space on
 “ which the rows stand, when the thaw comes on, or by the heavy
 “ rains which are frequent with us*.

“ The rest of my field is sowed in two rows, in beds four feet
 “ two inches wide. I have done this, because, as it is the general
 “ custom here to make our ridges about that breadth, I am in hopes
 “ that if I obtain a plentiful crop, I shall be able the more easily to
 “ prevail on the farmers of this country to adopt a method, the
 “ advantage of which I was sensible of, even before I tried the
 “ above experiments.

* These accidents, says M. Duhamel, may be prevented, by making the furrow in the middle of the alleys, at a greater distance from the rows; the water will then be drained off, without hurting the plants; and in March, the horse-hoe may be brought almost close to the rows, to loosen the mould about the roots, without any fear or danger.

SECT. IV.

Experiments on barley, by his Excellency M. BIELINSKI, grand marshal of Poland.

M. Bielinski gives the following account of this experiment; in a letter to M. Duhamel.

"On the 11th of May, I plowed and made into beds, with our common plough, about six hundred square perches of a large field near the gate of my castle. This situation gave me an opportunity of overseeing the work myself.

"The soil is very good, neither too strong nor too light; and as it was near my stables, it had been frequently dunged. It bore wheat the preceding year, and had been plowed twice after harvest. I sowed it with barley on the 12th of May, with the drill-plough. It took 159 Paris pints, and would have required about 720, if it had been sowed in the common way: consequently here was a saving made of near three fourths of the seed.

"On the first of June, the barley seeming strong enough, I hoed the alleys for the first time, with the light plough. The beds were but four feet wide; deducting from which eight inches, for the space where the barley grew, there remained three feet four inches for the alleys, which I at first thought very sufficient for all the necessary hoeings: but notwithstanding all the care that could be taken, some parts of the rows were carried off by the plough, and others were covered with earth. At least one sixth of the crop was lost by this accident. During all June, and part of July, my barley promised well, and branched considerably. Every plant that I examined had from 12 to 20 ears, which were easily distinguished from the barley sown in the common way, by their largeness, and the deep green colour of their blades.

"The second and third hoeings were performed on the 12th of June and 15th of July, with the cultivator, which did not damage the rows so much as the light plough had done.

"July was an exceeding hot month. By the 15th, the plants seemed to suffer by it, and the extreme sultry heat of the last days of that month put an entire stop to their vegetation. They languished afterwards, and the lower stalks withered before the grain was well formed. The birds too preyed upon it: so that I was forced to cut it down in the beginning of August. To complete

" the misfortune, it rained incessantly for five days after this corn
 " was cut, which made many of the ears sprout in the rick. Not-
 " withstanding all these accidents, my crop yielded 51 3/4 pints of
 " good clean barley: which is as much as I could have expected in a
 " middling year, if the field had been sown in the common way.
 " The crop would certainly have been greater, 1. If I had sown
 " the barley sooner; the heat having hurt only the late sown grain:
 " and, 2. If the beds had been larger: for then the summer culture
 " might have been given the alleys more conveniently, and without
 " tearing up or burying any part of the rows."

M. Duhamel, among many other experiments communicated to him by different correspondents, mentions the following made on oats, in a climate resembling that of Provence, as an instance of the advantage of sowing thin.

A field, bordering on a meadow was sown with oats. The owner, before he sowed it, dug a small ditch of 8 or 10 inches between this field and the meadow, to carry off the water intended for watering the meadow. The earth thrown out of this ditch was laid on the side of the field, where it made a little bank 18 or 20 inches wide, on which oats were sown, as on the rest of the field which had been well plowed. Some grains of oats fell all along the sloping side of this bank, next to the ditch, and, in general, at the distance of six, seven, or eight inches from one another. They produced 18, 20, and 25 stalks a piece, taller and stronger than those which grew upon the bank, though these were much superior to any in the rest of the field.

To be the more exact in his comparison, he picked out one of the finest stalks he could find in each of these three places. That which he took from the middle of the field was two feet five inches and one-third long, and had 91 grains of oats on it: that from the top of the bank was three feet nine inches and one-sixth in length, and bore 165 grains; and that from the side of the bank next the ditch was four feet nine inches long, and yielded 214 grains. The straw of this last was much stronger, and the grain larger and better filled, than any that grew in the field. The difference was so great that he thinks a third fewer of these grains would have filled a bushel, than of the others.

Mr. Miller is so sensible of the advantages of sowing thin, that he strongly recommends to farmers, instead of four bushels, which is the common allowance of barley, to an acre, to sow even less than half

half that quantity: "There will, says he, be a much greater produce, and the corn will be less liable to lodge, as I have many years experienced; for when corn or any other vegetable stands very close, the stalks are drawn up weak, and so are incapable to resist the force of winds, or bear up under heavy rains: but when they are at a proper distance, their stalks will be more than twice the size of the other, and therefore are seldom laid. — I have seen experiments made by sowing barley in rows a-cross divers parts of the same field, and the grains sowed thin in the rows, so that the roots were three or four inches asunder in the rows, and the rows a foot distance; the intermediate spaces of the same field were at the same time sown broad-cast in the usual way. The success was this: the roots which stood thin in the rows, tillerated out from ten or twelve, to upwards of thirty stalks on each root: the stalks were stronger, the ears longer, and the grains larger than any of those sown in the common way: and when those parts of the field where the corn sown in the usual way has been lodged, these parts sowed thin have supported their upright position, against wind and rain, though the rows have been made not only lengthways, but cross the lands in several positions, so that there could be no alteration in regard to the goodness of the land, or the situation of the corn: therefore where such experiments have been frequently made, and always attended with equal success, there can be no room to doubt which of the two methods is more eligible; since if the crops were only supposed to be equal in both, the saving more than half the corn sown, is a very great advantage, and deserves a national consideration; as such a saving, in scarce times, might be a very great benefit to the public.

"I know the farmers in general are very apt to complain if their corn does not come up so thick as to cover the ground green in a short time, like grass fields: but I have often observed, that when from the badness of the season it has come up thin, or by accident has been in part killed, their corn has been stronger, the ears longer, and the grain plumper; so that the produce has been much greater than in those years when it has come up thick: for the natural growth of corn is to send out many stalks from a root, and not to rise so much in height: therefore it is entirely owing to the roots standing too near each other, when the stalks are drawn up tall and weak. I have had eighty-six stalks upon one root of barley, which were strong, produced

"longer ears, and the grain was better filled, than any I ever saw
 "grow in the common method of husbandry, and the land upon
 "which this grew was not very rich: but I have frequently observed
 "on the sides of hot-beds in kitchen gardens, where barley straw
 "has been used for covering the beds, that some of the grains left
 "in the ears, have dropt out and grown, the roots have produced
 "from thirty to sixty stalks each, and those have been three or four
 "times larger than the stalks ever arrive at in the common way.
 "But to this I know it will be objected, that although upon rich
 "land in a garden, these roots of corn may probably have so many
 "stalks; yet in poor land they will not have such produce; there-
 "fore unless there is a greater quantity of seeds sown, their crops will
 "not be worth standing; which is one of the greatest fallacies that
 "can be imagined: for to suppose that poor land can nourish more
 "than twice the number of roots in the same space as rich land, is
 "such an absurdity, as one could hardly suppose any person of com-
 "mon understanding guilty of: and yet so it is; for the general
 "practice is to allow a greater quantity of seed to poor land, than
 "for richer grounds; not considering that where the roots stand so
 "close, they will deprive each other of nourishment, and so starve
 "themselves; which is always the case where the roots stand close,
 "as any person may at first sight observe in any part of the fields
 "where the corn happens to scatter when they are sowing it: or in
 "places, where, by harrowing, the seed is drawn in heaps, those
 "patches will starve, and never grow to a third part of the size of
 "the other parts of the same field: and yet, common as this is, it is
 "little noticed by farmers; otherwise they surely would not continue
 "their old custom of sowing. I have made many experiments for
 "several years in the poorest land, and have always found that all
 "crops which are sowed or planted at a greater distance than usual,
 "have succeeded best; and I am convinced that if the farmers could
 "be prevailed on to quit their prejudices, and make trial of this
 "method of sowing their corn thin, they would soon see the advan-
 "tage of this husbandry.

"The noblemen and gentlemen in France are very busy in
 "setting examples of this husbandry in most of their provinces, be-
 "ing convinced of its great utility, by making trials: and it were to
 "be wished the same was done in England."

CHAP. II.

Of the Culture of Millet.

MILLET requires the same kind of soil as maiz, viz. light and sandy, and it is prepared after the same manner. When the furrows are made, the grain is sowed very thin, and covered with the plough, or rake. The time of sowing it is, either between the 15th of May, and 1st of June, or about the 24th of June: this last is called midsummer millet.

A month after it has appeared above ground, the earth round the plants is stirred with a hand hoe, and at the same time they are thinned with the same instrument wherever they grow too close together. The space of six inches is generally left between each plant.

After this operation, the plants are left to themselves: all that the husbandman has to do from this time, is, to protect the grain from birds, when it begins to ripen; for otherwise they will soon devour it.

The millet sown in May, is cut down between the 15th and 30th of September: that which has not been sown till the end of June, is not reaped till towards the end of October.

It has always been observed, that the midsummer millet has most abortive grains; and that its panicles being smaller than those of the same grain sown earlier, the crop is likewise less plentiful: accordingly, farmers, seldom, or never, sow it in this last season, unless some other plant has taken up their ground till then.

Millet is reaped as follows. The panicles are cut off with a knife near the uppermost joint of the stalk. These panicles are put into baskets or sacks, in which they are carried home, and emptied out in heaps which are covered over with cloths. After the millet has remained in this situation five or six days, it is spread upon the barn floor, and threshed out with a flail. It is then cleans'd, like other grain.

After the millet is cleans'd, care must be taken to dry it well in the sun, before it is laid up in the granary: for it would soon spoil if the least moisture were left in it; this being of all grains the most difficult to keep, unless it be thoroughly dry: and on the other hand, none keeps better after it has been well dried: it is not liable to the weevil: it should be turned from time to time in the granary; but if that happens now and then to be neglected, it still keeps perfectly well.

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There are two sorts of millet; viz. red and white. The red millet is used only for poultry: the white millet, besides being put to that use, is mixed with wheat, and made into bread. It likewise makes very good puddings.

In some of their poor light lands about Bourdeaux, they sow another kind of millet, generally known by the name of *forgo*, and in that country called *millico*. It is cultivated in the same manner as the former, with this difference only, that the plants of this kind of millet must be farther asunder than those of the other, because their branches grow much higher, and spread a great deal wider. This millet is reaped at the same time, and in the same manner as the white millet. The peasants near Bourdeaux make bread of this *forgo*. It is reddish, heavy, ill-tasted, and hard to digest. Pigeons and poultry are fond of this grain.

Millet is a great impoverisher of the earth. For this reason, as soon as it is reaped, great care is taken to pull up the roots and plow the land immediately. It may be worth while to try to cultivate it, and especially the larger kind, with our cultivator. As this plant requires a great deal of nourishment, probably the frequent stirring of the earth in the new husbandry, may be of service to it.

CH A P. III.

Shewing the resemblance between the culture of rice in China, and the new method which we have proposed for the culture of wheat.

MY Printer, says M. Duhamel, having received from China two books of drawings, in which the culture of rice is represented, and the subject briefly explained in Chinese verses; father Foureau, a jesuit, who lived ten years in that country, has been so kind as to translate them; which enables me to form a clear idea of all the operations relative to that culture.

1. To hasten the sprouting of the rice, it is put into baskets, and soaked for some days in a standing water.

2. When their rice grounds are so soaked with water as to be quite like mud, they plow them with a buffalo yoked to a plough very simple in its make, having but one share, one handle, and no wheels.

3. After a gentle rain, they break the clods with a kind of large hurdle, drawn by a buffalo; the driver sitting upon it, to increase the weight.

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4. The ground is cleared of all stones, and whatever roots are in it are pulled up by a strong harrow, with great iron teeth. This instrument is drawn by a buffalo, and a man guides it with the help of two handles, like those of a plough, on which he leans hard. The earth is like mud, and partly covered with water during all this operation.

5. The earth is afterwards smoothed with a harrow, which has several rows of teeth. A man guides this harrow by its two handles, whilst a buffalo draws it: and as fast as its teeth form little channels in the ground, the water runs in, and fills them up.

6. When the rice that was laid to soak has sprouted, the seed is known to be good; and it is then sown by hand, very thick, and as equally as possible. Only part of the ground is sown in this manner, to furnish plants for the rest.

The day after it has been sown, the points of the plants appear above the surface of the water: for the ground is overflowed all this time with just enough water to cover it.

7. When the plants have acquired a little strength, they are sprinkled with lime water, to destroy the insects and some of the weeds that would hurt them. For this purpose a small basket is fastened to the end of a long handle, and dipt in lime water, which runs through it, as it is conveyed over the plants.

The Chinese have a great veneration for the first inventor of this method, which answers to our custom of steeping wheat in lime-water, or manuring land with quick-lime.

8. Towards April, when the plants are grown strong enough to cover the whole field, and look very green and even, the greatest part of them is pulled up by handfuls, all the mud is carefully washed off their roots, and, being held all this time as even as possible with one another, they are planted in tufts, pretty far asunder, and in a quincunx form, in fields prepared on purpose for them. A serene day is chosen for this operation, which must be performed as quick as possible.

This practice of the Chinese is in regard to the common culture of rice, what our new husbandry is with respect to the common culture of wheat.

9. The rice must be watered: which is always done in China, by overflowing it. To this end, the rice grounds are always near a pond.

pond or great pool of water, from which they are separated only by a bank, or causey.

If the water were higher than the rice ground, a trench cut through the causey would overflow it at once: but as it is generally lower, or on a level with the rice ground, the necessary quantity is conveyed in pails or buckets, which are worked chiefly by the help of ropes.

10. Though a man cannot step in these rice grounds without being up to his knees, the Chinese weed them three times in a summer; and that with such care, that they pull up even the roots of every weed.

11. When the rice is ripe, which is known by its turning yellow, like wheat, it is cut down with a sickle, made into sheaves, and carried to a barn, where it is threshed with flails pretty much like ours: the straw is removed with pitchforks and shovels, and the outer husk of the grain is taken off by beating it with great wooden pestles, or a kind of mallet; after which it is sifted and winnowed; and lastly, to get off the under husk, the grain is put between two mill-stones, which are worked by a lever fastened to the upper one.

The two most remarkable circumstances of this culture are,
1. The care which the Chinese take not to let their plants be too close together, lest they should rob one another of their food.
2. Their weeding their rice grounds three times in a summer, which answers the end of the hoeing we recommend for the alleys between the beds of other grain.

The following is the description of a Chinese plough, of which the Jesuits sent a model from China.

Plate I. Fig. 1. *AA* are the two shafts, *BB* two shares, *CC* the handles by which the driver guides the plough, and *D* a box in which the seed is put.

As the plough advances, the shares open two furrows, and the seed in the box *D*, drops through an outlet *E* in its hinder part, and falls into a trough *F*, at the bottom of which are two holes, one answering to a pipe *G*, which communicates with a hollow bored in the piece of wood *H*, and terminates in an outlet at the back part of the share *I*: the other hole in the trough conveys the seed to the outlet *M* at the back part of the other share, through the pipe *NO*, as on the other side before described.

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Now it is easy to conceive that the seed which drops out of the box *D* into the trough *F*, and from thence into the pipes *GH* or *NO*, comes out at the openings *I* or *M*, and falls into the furrows as the shares open them: and the roller *L* which follows, fills up the furrow. But we see no moderator here, by the help of which more or less seed may be sown at pleasure. If the pipes and outlets are too large, the seed will drop in too great quantities; and if they are too small, they will be apt to be choked up, and the seed will not drop at all. Perhaps any one that has seen this plough work, might be able to answer these difficulties: but as it appears to me, I doubt it would not do for sowing wheat according to our principles.

This is thought to be the plough which the Chinese make use of to sow rice: if so, their culture of that plant is still more like the practice which we recommend for corn in general.

CHAP. IV.

Experiments on Leguminous Plants.

M. Eyma, of Bergerac, near Bourdeaux, sowed peas, beans, and kidney-beans, each seed a foot distant from another in the rows, and the rows two feet asunder. They yielded a much more abundant crop, than any in the common husbandry.

In April 1753, *M.* de Villiers sowed 80 square perches of 22 feet each, with peas, in double rows. Not being provided with any proper instrument to hoe the alleys, he made use of a narrow angular kind of share, which stirred only three or four inches on the outside of the rows. Almost all the peas in that country were destroyed this year by a kind of vermin called vine-fetters. His were hurt the least of any; which was probably owing to the greater vigour of the plants, or to the insects being killed by the stirring of the ground. By a comparison which he made of the produce of this spot, he found that it yielded six times as much as the same extent of the best land in those parts. In a good year, the difference would not have been so great: but still this experiment shews, that plants cultivated in the new way, are better able to resist the inclemencies of the seasons, and other accidents, than those which are cultivated according to the old method.

The next year, being provided with *M.* Duhamel's drill and horse-hoe, he sowed peas, and barley. The alleys were but two feet,

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and two feet and an half wide, which rendered the horse-hoeing very difficult in many places, and quite impracticable in others. This obliged him to contrive other methods of stirring the ground. The peas flourished extremely, and produced more than the very best fields thereabouts. The barley, tho' sown too thin, yielded likewise more than that of any other field.

In December 1755, M. Eyma planted the common sort of garden-beans, in a middling soil, not dunged, but extremely well plowed a foot deep. The rows were two feet asunder, and the plants a foot distant from each other. These beans, which every one thought much too thin sown, being assisted by frequent hoeings, yielded a greater crop than any in the common way. M. Eyma, finding his beans begin to ripen, gave the alleys a good plowing, and on the twenty-third of June, sowed in each of them a row of red kidney-beans, which came up very well. A fortnight after, he plucked up the garden-beans, and gave the earth they grew on a slight hoeing. The kidney beans proved the finest he ever saw. He purposes, as soon as they are off the ground, to replant it with garden-beans, and he hopes with better success than before.

In 1755, M. de Villiers sowed peas in a strong heavy soil, in which no one had ever ventured to sow any in the common husbandry. They grew as high as if the ground had been ever so fit for them, and yielded half as much again as any sown in the common way, besides the saving in the seed, which, in peas, is about one half. They were sown in double rows; and the alleys, which were two feet, and two feet and an half wide, were hoed with the single cultivator.

With regard to the distance at which garden-beans should be planted, Mr. Miller lays down, as a general rule, that the larger beans should be planted at a greater distance than the small ones, and that those which are first planted should be put closest together, to allow for some miscarrying. He therefore advises, where a single row is planted, and that early, to put the beans two inches asunder, and to allow those of the third and fourth planting three inches; and when they are planted in rows a-cross a bank, "the rows, says he, should be two feet and an half asunder: but the windfor-beans" should have a foot more space between the rows, and the beans "in the rows should be planted five or six inches asunder. This distance, continues he, may, by some persons, be thought too
" great;

“ great: but from many years experience, I can confirm, that the
 “ same space of ground will produce a greater quantity of beans,
 “ when planted at this distance, than if double the quantity of seeds
 “ are put on it. In the management of these latter crops of beans,
 “ the principal care should be to keep them clear from weeds, and
 “ any other plants, which would draw away their nourishment; to
 “ keep earthing them up, and, when they are in blossom, to pinch
 “ off their tops, which, if suffered to grow, will draw the nourish-
 “ ment from the lower blossoms, which will prevent the pods
 “ from setting, and so only the upper parts of the stems will be
 “ fruitful: and another thing should be observed in planting of the
 “ succeeding crops, which is, to make choice of moist strong land
 “ for the later crops; for if they are planted on dry ground, they
 “ rarely come to much.—In warm dry light land, all the late
 “ crops of beans are generally attacked by the black insects, which
 “ cover all the upper part of their stems, and soon cause them to
 “ decay.

“ The horse bean delights in a strong moist soil, and an open ex-
 “ posure: for they never thrive well on dry warm land, or in small
 “ inclosures, where they are very subject to blight, and are fre-
 “ quently attacked by a black insect, which the farmers call the
 “ black dolphin. These insects are often in such quantities, as to
 “ cover the stems of the beans entirely, especially all the upper part
 “ of them, and when this happens, the beans seldom come to
 “ good: but in the open fields, where the soil is strong, this rarely
 “ happens.

“ These beans are usually sown on land which is fresh broken up,
 “ because they are of use to break and pulverize the ground, as also
 “ to destroy weeds; so that the land is rendered much better for
 “ corn, after a crop of beans, than it would have been before;
 “ especially if they are sown and managed according to the new hus-
 “ bandry, with a drill-plough, and the horse-hoe, and to stir the
 “ ground between the rows of beans, which will prevent the growth
 “ of weeds, and pulverize the ground, whereby a much greater
 “ crop of beans may, with more certainty, be expected, and the
 “ land will be better prepared for whatever crop it is designed for
 “ after.

“ The season for sowing of beans is from the middle of February
 “ to the end of March, according to the nature of the soil: the
 “ strongest and wet land should always be last sown. The usual

"quantity of beans, sown on an acre of land, is about three bushels:
 "but this is double the quantity which need be sown, especially
 "according to the new husbandry."

As neither M. Duhamel nor his correspondents, are very particular in relation to the culture of this useful plant, we beg leave to add Mr. Miller's directions for the management of beans, according to the new husbandry.

"The ground, says he, should be four times plowed before the
 "beans are set, which will break the clods, and render it much
 "better for planting. Then, with a drill-plough, to which a hopper
 "is fixed for setting of the beans, the drills should be made at three
 "feet asunder, and the spring of the hopper set so as to scatter the
 "beans at three inches distance in the drills. By this method, less
 "than one bushel of seed will plant an acre of land. When the
 "beans are up, if the ground is stirred between the rows with a
 "horse plough, it will destroy all the young weeds; and when the
 "beans are advanced about three or four inches high, the ground
 "should be again plowed between the rows, and the earth laid up
 "to the beans: and if a third plowing, at about five or six weeks
 "after, is given, the ground will be kept clean from weeds, and the
 "beans will stalk out, and produce a much greater crop than in
 "the common way.

"When the beans are ripe, they are reaped with a hook, as is
 "usually practised for peas; and after having lain a few days on the
 "ground, they are turned, and this must be repeated several times,
 "until they are dry enough to stack: but the best method is to tie
 "them in small bundles, and set them upright; for then they will
 "not be in so much danger to suffer by wet, as when they lie on the
 "ground; and they will be more handy to carry and stack, than if
 "they are low. The common produce is from twenty to twenty-
 "five bushels on an acre of land.

"The beans should lie in the mow to sweat, before they are
 "threshed out: for as the haulm is very large and succulent, so it is
 "very apt to give and grow moist: but there is no danger of the
 "beans receiving damage, if they are stacked tolerably dry, because
 "the pods will preserve the beans from injury; and they will
 "be much easier to thresh after they have sweat in the mow, than
 "before; and after they have once sweated, and are dry again, they
 "never after give.

"By the new husbandry, the produce has exceeded the old by
 "more

“ more than ten bushels on an acre: and if the beans which are
 “ cultivated in the common method are observed, it will be found
 “ that more than half their stems have no beans on them; for by
 “ standing close, they are drawn up very tall, so the tops of the
 “ stalks only produce, and all the lower part is naked; whereas in
 “ the new method, they bear almost to the ground; and as the
 “ joints of the stems are shorter, so the beans grow closer together
 “ on the stalks.”

C H A P. V.

Experiments on Pot-berbs, &c.

M. de Chateau-vieux, being of opinion that if pot-herbs could be cultivated in the same manner as wheat is in the new husbandry, a great expence in dung and labour might be saved, made the following experiments.

“ I begun, says he, by retrenching the dung: tho’ the spot I chose for my first trial had not received any for several years. It had indeed been well prepared by the plowing of the preceding year, when one half of it bore barley, and the other oats. I now made it into a bed, the middle of which was directly over the last year’s furrow.

“ I plowed this bed, on the 25th of September, 1751, in the same manner as if it had been intended for wheat. I planted on it a single row of white cabbages, which I watered, to make them take root the better. The length of this bed was 160 feet, and its breadth six feet seven inches.

“ That I might be able to make a just comparison between the cabbages of this bed, and those of the kitchen garden, I planted a spot of ground in this last place, the same day, with the same sort of plants. This spot had been extremely well dug, and plentifully dunged by the gardener, who took all possible care of these plants all the summer, and weeded and watered them as often as was necessary. Instead of cabbaging, most of them ran up in height: upon which I plucked them up, and planted others in their stead.

“ I bestowed the same care and culture on my rows of cabbages in the bed, as if they had been wheat.

“ On the 9th of March, 1752, the alleys were stirred with the plough. On the 25th of April, I gave them a second stirring with the cultivator. On the third of June, they had a third stirring with the plough: and on the 20th of July, I made my gardener hand-

hoe them, for fear the plough should damage several stalks of wheat which grew on the next bed, and were bent, but not lodged.

"These cabbages were never watered, except once, which was at the time of planting them; and yet they were always crisp and firm, even in the hottest days. By this easy and expeditious culture, they attained all the perfection that could be wished; and surpassed those of the kitchen garden, as much in goodness, as they did in bulk. Most of them weighed between 15 and 18 pounds, and the smallest between eight and ten. The weight of all the plants which grew on this bed, was upwards of 840 pounds.

"Toward the end of autumn, I prepared five other beds, to be sown in the spring, in the same field as that of the cabbages, to which they lay in right angles. The form of this spot did not admit of making the beds more than 40 feet long. This space being too small to use the plough in, it was dug with the spade, and made into beds the latter end of November. The middle of the beds was raised pretty high, and a deep furrow parted them. The breadth from furrow to furrow was six feet. No dung was used.

"The winter's frost made the mould quite loose and fine. I found it in so good condition, that I thought it needless to give it another digging before I sowed it; which is very remarkable: for as these beds were not sown till the 4th of May, the ground had consequently not been stirred for upwards of five months.

"I only made a shallow furrow in the middle of each bed, in one of which I sowed beet, in two others carrots, and in the other two scorzoneras. The mould was in a due degree of moisture: the plants came up very well: they were thinned wherever they grew too thick, so as to leave a distance of 14 or 15 inches between the beet roots, seven or eight inches between the carrots, and four or five inches between the scorzoneras. None of these plants were watered at all.

"This spot being, as I before said, too small to admit the plough, the alleys between these beds were stirred by hand, with a spade, on the 15th of June, 27th of July, and 6th of September. The leaves of the plants were three or four times larger than those of the same kind of plants in the kitchen garden; and though the rows were six feet asunder, the leaves of the carrots met in many places, in the middle of the furrows between the beds.

"The beet roots were dug up the 25th of October. They were all nearly

nearly of the same size, viz. five or six inches in diameter, towards the top, or thickest part; which was much larger than any in the kitchen garden.

"The carrots were taken up the 8th of November. My gardener, who, when he sowed them, would have betted all he had in the world, that the crop would not be worth the digging, was astonished at their size. They were from 18 to 20 and 25 inches long, and from two and a half to three and a half and four inches in diameter, and weighed from 25 to 30 and 33 ounces each.

"The scorzoneras throve well, and their leaves were very large: till, on the 17th of August, when I had not seen them for a week, I found them totally changed, their leaves withered, and hanging on the ground. Upon opening a furrow on one side of them, to lay their roots bare, I found them entirely covered with small white slugs. I filled up part of this furrow with soot, in hopes that its bitterness would drive them away. For some days, there were much fewer of them, and the plants seemed to recover a little strength: but their enemies returned in so great numbers, that they soon destroyed them all, a very few roots excepted, which, notwithstanding the injury they had received, were larger at the end of six months, than those in the kitchen garden were at the end of nineteen.

"Besides the great advantage already mentioned, which all these plants had over those of the same kind in the kitchen-garden; they had two others, well worthy our attention. In the first place, they were much more tender and delicate, and their flavour higher and more pleasing to the palate: and secondly, they required much less time to boil them, than those raised in the kitchen garden. I do not impute this solely to my not using dung: the new husbandry had likewise its share in this improvement; the juices of plants being certainly most perfect in ground that is often stirred: the sun and air have then an easier access to the plants, and keep them sound; and the dews penetrate to their roots, as deep as the mould is sufficiently loose. I am persuaded that the perfection of these plants, was entirely owing to these causes. To have raised them in beds, and given them the same culture as wheat receives, would have been but an imperfect experiment, had I not likewise banished the use of dung. This last point was absolutely necessary, in order to know with certainty what earth alone is capable of doing, when managed according to the principles of the new husbandry.

"In 1753, I repeated my experiments on the same plants, viz. cabbages,

cabbages, beet-roots, carrots, and scorzoneras; and all of them were as fine, and well-flavour'd, as before.

"I likewise planted a bed of colliflowers this year, which were transplanted on the 9th of June. On the 20th of August, I cut the two first heads, which were very fine, and of an excellent taste. Cardoons, cultivated in the same manner, grew very fine, though they were greatly retarded by a shower of hail.

"I am now trying to raise more lasting plants, by cultivating them according to the new husbandry. To this end, I have laid down a bed of 32 perches long and six feet wide, and planted it, on the 24th of March, with a row of asparagus, which have made good shoots this first year.

"I have several beds six feet wide, planted with single rows of strawberries. The vigor of the plants, the largeness of the leaves, and the very great number of roots, give me room to expect that the fruit will be very large and plentiful.

"The success I have already had, the ease with which this culture is performed, the advantage of not using dung, and that of being eased of the trouble of watering, so necessary in kitchen gardens, that, in hot weather, it takes up almost the whole of one man's time, are considerations of such weight, as determined me to continue these experiments.

"Accordingly, in 1754, I raised the same plants again in beds, and with the same success: for they were equally beautiful and good. Tho' the year was very hot and dry, I watered none of them, except at the time of transplanting, to make them take the better. Those that were left where they were sown, were not watered at all. This shews how much the new husbandry preserves a moisture in the earth.

"The strawberries, this year, were admirable, extremely large, finely scented, and of a very high flavour.

"The asparagus, which was in its second year, was as fine as any in the best cultivated gardens.

"Artichokes planted at the end of May, produced their first fruit in September, which was, in general, from 12 to 15 inches in circumference. Their leaves entirely covered the beds six feet wide.

"I have raised even melons in the same manner, without any dung, or hot bed, and without bell-glasses, or any glass-frame to cover them. I sowed them as I would have done wheat. The plants

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came up perfectly well, and the fruit was so large and finely flavoured, that it might claim a preference in all respects to any that grew in my garden.

"I raised the same plants again in 1755 and 1756, in the same manner, and with the same success as before. They have always been larger, better tasted, and in every respect finer, than those of my kitchen garden. Nothing could be more striking, than, in 1755, a hot dry year, to see these plants always green, and in great vigor, thrive without any alteration; whilst those in gardens, which were watered every day, droop'd during part of the day, and grew but very slowly.

"We may place the greater confidence in these experiments on pot-herbs, as they have been cultivated in the same manner for several years, and always with the same success. The beauty, largeness, and vigor of the plants, cannot be imputed to dung or other manure, for none was used; nor did they want watering, to which I never had recourse, but when any of them were transplanted. It is therefore to the culture that their flourishing growth must be ascribed: and this is the more remarkable, as it is well known, that, in the common management of kitchen gardens, if the ground was not to be dunged for several years, it would produce only poor and stunted plants."

M. de Chateau-vieux extended the new husbandry to the culture of the *teazle*, or fuller's thistle, which grew to a surprising height, and produced an extraordinary number of the finest and best heads that the fullers of that country had ever seen.

This plant is of such importance to the woollen manufactory, in which it is used for raising the knap upon cloth, that we must beg leave to add here Mr. Miller's directions for the culture of it.

"It is propagated," says he, "by sowing the seeds in March, upon a soil that has been well dried. About one peck of this seed will sow an acre; for the plants should have room to grow; otherwise the heads will not be so large, nor in so great quantity. When the plants are come up, you must hoe them in the same manner as is practised for turneps, cutting down all the weeds, and singling out the plants to about six or eight inches distance; and as the plants advance, and the weeds begin to grow again, you must hoe them a second time, cutting out the plants to a wider distance; for they should be, at last, left at least a foot asunder; and you should be particularly careful to clear them

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"from weeds, especially the first summer; for when the plants have spread so as to cover the surface of the ground, the weeds will not so readily grow between them. The second year after sowing, the plants will shoot up heads, which will be fit to cut about the beginning of August; at which time they should be cut and tied up in bunches, setting them in the sun, if the weather be fair; but if not, they must be set in a room to dry them. The common produce is about an hundred and fifty bundles or staves upon an acre, which are sold for about one shilling a staffe."

M. Duhamel relates, that a friend of his had exceeding large carrots, by planting young carrots in a kitchen-garden, a foot asunder. Those which were sown thicker, remained small and stunted. These large carrots were tender and of a good taste.

From this, and some other experiments of the same kind, he draws the following conclusions. 1. That plants extend their roots farther than is generally imagined. 2. That it is proper to give each plant sufficient room to extend its roots in search of its necessary food: and 3. That plants which grow too thick, hurt one another, and yield but small productions.

In 1755, M. Duhamel himself sowed a piece of ground with carrot, beet, and scorzonera seed, and planted the remainder of it with young cabbages. All these plants were heeded according to the practice of the new husbandry, and not watered at all. The cabbages were very fine, and the carrots, beet-roots, and scorzoneras, the finest that had ever been seen.

In 1756 he sowed the same ground again, as before, and with the like success, excepting that the beets and carrots were too thin, because some of the seeds did not grow. The cabbages were exceeding fine; and kidney beans, which he added this year, came to great perfection.

M. Barbuat, M. D. towards the latter end of August, 1755, planted winter cabbages two feet asunder, and set three locks between each cabbage. He stirred the ground about them three times, at the distance of six weeks between each stirring. They became larger and better tasted, than those that were cultivated in the common way.

In February, he sowed onions, which having been neglected till towards the middle of May, were most of them choked with weeds. He ordered these weeds to be pulled up, and, contrary to the advice of all the gardeners near him, gave his onions, which were

were thin sown, two hoeings. Most of them grew to four and four inches and an half in diameter.

M. Duhamel concludes his account of this culture of pot-herbs, with the following extract of a letter from a gentleman near Lyons.

"My pot-herbs in beds are the admiration of all who see them.
 "My colliflowers were very fine, and on the fifth of July (1755)
 "run up to seed, and in all probability will produce a great deal;
 "which was never known before in this country*. I have cab-
 "bages which, I dare say, will weigh upwards of 45 pounds. I
 "had some last year which weighed 35 pounds, but the ground
 "was not so well cultivated then, as it is now, nor were they so
 "early. They have suffered nothing from the drought; but, on
 "the contrary, the warmer the weather has been, the finer they
 "have grown. They have not been watered at all: nor have my
 "carrots, which are now a foot in circumference: and I have
 "cabbage lettuces which weigh five pounds. One great advantage
 "which I find in the new husbandry, is that plants are preserved
 "from the danger of too much rain, or too great drought. The
 "earth, when well cultivated, is always in a moist state. The
 "more I reflect on this new method of culture, the more I admire
 "it. None but those who are thorough judges of agriculture,
 "can foresee the immense advantages that will hereafter attend
 "it."

The great use that may be made of some of the plants treated of in this chapter, for the food of cattle, seems to have escaped M. Duhamel's attention. As their size, and consequently their quantity, is capable of being prodigiously increased by means of the new husbandry, this consideration is the more important. We shall therefore endeavour to supply our author's deficiency in this re-

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spect,

* The colliflower, as Mr. Miller observes, has been much more improved in England, than in any other part of Europe. In France, they rarely have colliflowers till Michaelmas; and Holland is generally supplied with them from England. In many parts of Germany, there was none of them cultivated till within a few years past; and most parts of Europe are supplied with seeds from hence. This plant was first brought to England from the island of Cyprus, where it is said to be in great perfection at present; tho' it is supposed to have been originally brought thither from some other country. It was not brought to any degree of perfection in England, till about 1680, at least not to be sold in the markets; and since the year 1700, they have been so much improved in England, that such of them as before were greatly admired, would at present be little regarded.

spect, by borrowing from Mr. Miller what is pertinent to our subject.

"Where carrots," says he, "are designed to have large roots," (which certainly will always be the case, when they are intended for fodder,) "they must never stand too close, nor should they have any other crop mixed with them.—This root has long been cultivated in gardens for the table, but has not, till of late years, been cultivated in the fields for cattle, nor has it been practised as yet, but in few parts in England. It is therefore greatly to be wished, that the culture of it was extended to every part of England, where the soil is proper for the purpose: for there is scarce any root yet known, which more deserves it, being a very hearty good food for most sorts of animals. One acre of carrots, if well planted, will fatten a greater number of sheep, or bullocks, than three acres of turneps, and the flesh of these animals will be firmer and better tasted. Horses are extremely fond of this food, and for hogs there is not any better. I have also known these roots cultivated for feeding of deer in parks, which has proved of excellent use in hard winters, when there has been a scarcity of other food, at which times great numbers of deer have perished for want; and those that have escaped, have been so much reduced, as not to recover their flesh the following summer; whereas those fed with carrots have been kept in good condition all the winter, and upon the growth of the grass in the spring, have been fat early in the season; which is an advantage, where the grass is generally backward in its growth.

"There is also an advantage in the cultivation of this root, beyond that of the turnep, because the crop is not so liable to fail: for as the carrots are sown in spring, the plants generally come up well; and unless the months of June and July prove very bad, there is no danger of the crop succeeding: whereas turneps are frequently destroyed by the flies at their first coming up; and in dry autumns they are attacked by caterpillars, which in a short time devour whole fields; but carrots are not attacked by these vermin. Therefore every farmer who has a stock of cattle or sheep, should always have a supply of these roots, if he has land proper for the purpose, which must be light, and of a proper depth to admit of the roots running down.

"In preparing of the land for carrots, if it has not been in tillage before, it should be plowed early in autumn, and then plowed

“ a-crofs again before winter, laying it up in high ridges to mellow
“ by the frost: and if the ground is poor, there should be some
“ rotten dung spread over it in winter, which should be plowed in
“ about the beginning of February: then in March, the ground
“ should be plowed again to receive the seeds; in the doing of
“ which, some farmers have two ploughs, one following the other
“ in the same furrow, so that the ground is loosened a foot and a
“ half deep: others have men with spades following the plough in
“ the furrows, turning up a spit of earth from the bottom, which
“ they lay upon the top, levelling it smooth, and breaking the clods:
“ the latter method is attended with a little more expence, but is
“ much to be preferred to the first; because in this way the clods
“ are more broken, and the surface of the ground is laid much
“ even.

“ If the land has been in tillage before, it will require but three
“ plowings; the first just before winter, when it should be laid in
“ high ridges; the second cross plowing should be in February;
“ after which, if it is well harrowed to break the clods, it will be
“ of great service: the last time must be in March, to receive the
“ seeds: this should be performed in the manner before mentioned.
“ After this third plowing, if there remain great clods of earth un-
“ broken, it will be proper to harrow it well before the seeds are
“ sown. One pound and a half of seeds will be sufficient for an
“ acre of land: but as they are apt to adhere together, so it renders
“ them more difficult to sow even, than most other sorts: therefore
“ some mix a quantity of dry sand with their seeds, rubbing them
“ well together, so as to separate the carrot seeds from each other,
“ which is a good method. After the seeds are sown, they must
“ be gently harrowed in to bury them; and when the plants come
“ up, they should be hoed.

“ But in order to preserve your carrots for use all the winter and
“ spring, you should, about the beginning of November, when the
“ green leaves are decayed, dig them up, and lay them in sand in
“ a dry place, where the frost cannot come to them, taking them
“ out from time to time as you have occasion for them; reserving
“ some of the longest and straightest roots for seed, if you intend to
“ save any; which roots should be planted in the middle of Febru-
“ ary, in a light soil, about a foot asunder each way, observing to
“ keep the ground clear from weeds: and in the middle of Au-
“ gust, when you find the seed is ripe, you must cut it off, and carry
“ it

“ it to a dry place, where it should be exposed to the sun and air
 “ for several days, to dry: then you may beat out the seed and put
 “ it up in bags, keeping it in a dry place until you use it. This
 “ seed is seldom esteemed very good after the first, or second year at
 “ most, but new seed is always preferred; nor will it grow after it
 “ is more than two years old.”

Parsneps are another excellent, wholesome, and very nourishing food for cattle. Their culture is the same as that of carrots, with which they may be sown on the same ground; observing, if you would have the roots of either grow to their full size, to thin them so as to leave a space of ten inches or a foot between each plant, and to keep them clear from weeds by frequent hoeings. When the leaves begin to decay, the roots may be dug up for use, and kept in sand, in a dry place. Parsnep seeds seldom grow after they are above a year old.

We could wish that M. Duhamel, or his correspondents, had tried the culture of parsley according to the new husbandry, in which there is no doubt of its succeeding well, and proving of great benefit to sheep. “ The common parsley, says Mr. Miller, is, by some
 “ skilful persons, cultivated in fields for the use of sheep; it being
 “ a sovereign remedy to preserve them from the rot, provided they
 “ are fed twice a week for two or three hours each time with this
 “ herb: but hares and rabbits are so fond of it that they will come
 “ from a great distance to feed upon it; and in countries where these
 “ animals abound, they will destroy it, if it is not very securely
 “ fenced against them: so that whoever has a mind to have plenty
 “ of hares in their fields, by cultivating parsley will draw all the
 “ hares of the country to them. — The best time for sowing it in
 “ the fields is about the middle or latter end of February: the
 “ ground should be made fine, and the seeds sown pretty thick, in
 “ drills drawn about a foot asunder, that the ground may be kept
 “ hoed between the drills, to destroy the weeds, which, if permitted
 “ to grow, will soon over-run the parsley. Two bushels of seed
 “ will sow one acre of land. — The roots of the great garden-
 “ parsley will grow, if sufficient room is given them, to the size of
 “ a middling parsnip, and are greatly esteemed by the Dutch for
 “ their *water fouches*. They may also be boiled and eaten as young
 “ carrots, and are very palatable and wholesome, especially for those
 “ who are troubled with the gravel.

“ The *napus sylvestris*, or wild navew, generally known by the
 “ name

“ name of rape or cole seed, is much cultivated in the isle of Ely,
 “ and some other parts of England, for its seed, from which the
 “ rape oil is drawn: and it hath also been cultivated of late years,
 “ in other places, for feeding of cattle, to great advantage.—The
 “ cole seed, when cultivated for feeding of cattle, should be sown
 “ about the middle of June. The ground for this should be pre-
 “ pared in the same manner as for turneps. The quantity of seeds
 “ for an acre of land, is from six to eight pounds, and as the price
 “ of the seeds is not great, so it is better to allow eight pounds; for
 “ if the plants are too close in any part, they may be easily thinned
 “ when the ground is hoed. When the plants have put out six
 “ leaves, they will be fit to hoe, which must be performed in
 “ the same manner as is practised for turneps.

CHAP. VI. SECT. I.

Of the common culture of Turneps.

THIS root is now cultivated more for feeding and fattening of cattle, and particularly sheep, than for the food of men.

It is sown in different seasons of the year, but chiefly at the end of June, during all July, and in the beginning of August; taking advantage of every rain that falls during this time; for that is necessary to make the seed sprout.

It is sown in land that has been well dunged and thoroughly plowed. The seed is sown by hand, as equally as possible, and covered with the harrow, about an inch deep; for if it were covered deeper, there would be danger of its not rising.

When the turneps appear above ground, the farmer examines where they have failed, in order to sow fresh seed, which he covers with the rake. When the turneps are about the bigness of a finger's end, they are carefully hoed, to keep them from weeds which would hurt them greatly, and to thin the plants where they are too thick: for a few large turneps are more profitable than a greater number of small ones.

These plants require scarce any other culture: only they must be shelter'd from all kinds of cattle, and especially hogs, who would soon turn up the whole field in search of these roots, which they are very fond of.

SECT.

S E C T. II.

Of the culture of Turneps, according to the new husbandry, by

M. DUHAMEL.

A Light sandy soil, somewhat moist, is the fittest land for all sorts of turneps: but with the help of good culture they may be raised in almost any soil, except chalk and clay, where they seldom do well.

It is proper to observe that all roots, such as turneps, parsneps, carrots, &c. thrive best where there is great depth of mould. We trenched our whole garden three feet deep. All the pot-herbs grew very fine, and roots in particular were of a surprising length and bigness.

This shews that the ground intended for turneps ought to be well stirred, and as deep as possible: and as turneps delight in a light soil, we must endeavour to bring the strong soils into that state, by the two means we have already mentioned as capable of producing that effect, viz. dung and plowing. If dung is wanting, the plowings must be repeated in proportion to the strength of the soil.

Turneps may be sown from the middle of May to the beginning of August, but the usual season is about midsummer. Their success depends greatly on the nature of the soil and the state of the weather.

An ounce of seed will sow as much land when drilled, as a pound will in the common way; because when care has been taken to sow only the necessary quantity of seed, there will be no occasion to thin the plants afterwards, when they are hoed.

The best way is to sow them in single rows six feet asunder. Mr. Tull sowed them in double rows; but they did not do well. He likewise sowed them in single rows, but at the distance of only three feet. These yielded more turneps than a neighbouring field which was sown and managed in the common way. But it is still better to leave a space of six feet between the rows; and if the alleys are well plowed to the depth of five or six inches, the turneps will thrive wonderfully, even tho' no other moisture falls but the dews, which will sink into the earth to their roots.

Notwithstanding Mr. Tull's experiment, I would sow them in double rows; or, if in single rows, those rows should be but four feet asunder. That is the space which is left in Languedoc between the rows of vines, and which is plowed with oxen.

If

If one was sure of having rain immediately after the turneps are sown, it would be right to sow them very shallow: but if no rain happens, they are best deeper in the earth, because they meet there with moisture sufficient to make them grow.

M. Tull, by drilling the seeds alternately at different depths in the earth, was sure to succeed in one part or other, whether the season was wet or dry. If wet, the seed slightly covered sprouted first, and in dry seasons, that which lay deepest was the first that rose.

This is an easy way of having two growths of turneps in the same field. There is another way, which is, to sow the seed of the last gathering, and seed that is two years old, for this last is longer before it rises than the new. An advantage attending the turneps rising at different times, is, that they may thereby escape the fly or grub, which often entirely destroy them. It is observed, that these flies often come suddenly in great swarms, and destroy the turneps as they rise; and that they sometimes disappear as suddenly, so that the turneps which rise a few days after in the neighbouring field, are not at all injured by them: consequently, when the turneps of the same field rise at different times, one or other may escape the ravage of these insects; for they destroy them only when in their seedling leaf.

One of the most effectual ways to preserve turneps from these insects, is, to run a heavy roller over the whole field, across the rows. This rolling hardens the surface of the earth so that they can neither get in or out, by which means they are destroyed. But this pressure of the earth would be very hurtful to the turneps, if the ground had not been deeply plowed, if it was moist, or if it was stiff and apt to bind. These inconveniences are however partly remedied, by hoeing the alleys as soon as the turneps have put forth their large leaves; for then they have nothing to fear from the insects, which the hoeing likewise helps to destroy. The horse-hoe is the only instrument with which this work can well be done, the earth being often so hard, that the hand-hoe would only scratch it.

When the season has been kindly, and all the seeds have grown, and the plants have not suffered by the fly or other insects, they must be thinned early, that the earth may not be exhausted by plants which are not intended to remain; for those that are left should be about a foot asunder.

When the turneps thrive well, only each alternate alley need be hoed at one time, and the others a few days after: because it is better to feed the plants by degrees, by dividing the hoeings in this manner;

T t

than

than to give them a great deal of food, by hoeing all the alleys at once, and afterwards leave them double the time without any culture at all.

This method of hoeing the alternate alleys, is attended with this advantage, that in case of hot dry weather, the plants are not killed; and heavy rains will do them the less damage: but it will not so effectually destroy weeds, which is always one of the great objects of the new husbandry.

Tho' the horse-hoe has approached the turneps as near as possible, it will be necessary to hand-hoe the spaces between them. This may be done at a small expence, as the other hoe has already stirred almost all the ground. An expert husbandman will bring the horse-hoe within two or inches of the plants.

When the turneps are grown large, there is no occasion to come so near them, lest their roots be hurt: nor is it necessary to hoe them, till they are about the height of one's finger's end.

All plants sown in single rows, are greatly benefited by this hoeing of the alternate alleys. For, 1. Four of these hoeings, which cost no more than two entire ones, are almost as beneficial to the plants as four complete hoeings. 2. A plant which finds a great deal of nourishment on one side, is better able to thrive without receiving so much on the other. 3. If in hoeing very near the plant, some of the roots are broke, those on this side not being, supply the wants of the plant, till the broken roots have made fresh shoots. 4. We may therefore ap-

* "When the turneps are sown in drills," says Mr. Miller, *Art. Rapum* "it will be the best way to hoe between every other row at first, and some time after to hoe the alternate intervals, by which method the plants will receive more benefit from the often stirring of the ground, than they would do, if all the intervals were hoed at one time; and the plants will be in less danger of suffering from the earth being thrown up too high on some rows, while others may be left too bare of earth: but when the earth has been thrown up on one side of the drill, it may be turned down again before the next interval is hoed, and this alternate moving of the plants will prepare the ground very well for the succeeding crop, as well as greatly improve the turneps: but as this plough cannot well be drawn nearer to the drills than two or three inches, the remaining ground should be forked, to loosen the parts, and make way for the fibres of the roots to strike out into the intervals; otherwise, if the land is strong, it will become so hard in those places which are not stirred, as to stint the growth of the turneps; and this may be done at a small expence: a good hand will perform a great deal of this work in a day, and whoever will make the trial, will find their account in practising it, especially on all strong land, where the turneps are much more liable to suffer from the binding of the ground, than they will be on a loose soil: but yet, in all sorts of ground, it will be of great service to practise this."

proach nearer to the turneps without fear of hurting them, or of forcing them out of the earth. When a farmer has a great quantity of turneps to hoe, they are sooner supplied by this culture, than they possibly could if all the alleys were to be hoed.

While the turneps are young, a furrow must not be left open near them; because the earth about them would become too dry; but there is no danger of this in the autumn, when they are grown strong and the earth is moist. M. Duhamel does not think it advisable neither to leave a furrow open near them during the winter, because they would be in greater danger of being hurt by the frost.

One alternate hoeing, or, which is the same thing, two half hoeings will be sufficient when the turneps are sown late. But when they are sown early, and many weeds grow, one hoeing will not be enough.

By means of this culture, M. Duhamel has seen turneps which weighed from sixteen to nineteen pounds; "and we may depend," says he, upon their weighing one with another twelve pounds apiece in a good soil, which is after the rate of 576 pounds weight of turneps on a square perch of 24 feet, and near sixty thousand weight upon an arpent. If, in a square of 24 feet, which is the great perch, turneps are planted in rows six feet asunder, there will be four rows, containing each 24 turneps, in all 96, weighing 1152 pounds; consequently the arpent will yield 115200 weight of turneps.

The chief use of turneps is, to feed cattle in the winter and spring, till there is a sufficiency of grass for their pasture; and as they are pulled up only as they are wanted, they take up the ground which should be sown with wheat, and sometimes even when it should be sowed with spring corn. In the new husbandry, they are no hindrance to sowing; for as the alleys are in good tilth, three rows of corn may be sown seven inches asunder between the rows of turneps; and when the turneps are pulled, the ground they grow on is hoed, and becomes the alleys between the beds of corn.

It is well known that oxen and cows are very fond of this food, which fattens them, and increases the milk of cows. Sheep too eat it readily, and thrive upon it*, when they have been used to it early; but they do not relish it when it has not been offered them till they are grown old: however, if they are kept fasting two or three days, most

* Parsley corrects the inconveniences which may arise from the too great moisture and coldness of the turneps, and therefore must be of singular use in wet low pastures. See p. 318.

of them eat it; and when they have once tasted it, they become very fond of, and feed kindly upon it. In some places, they feed their lambs with turneps till the middle of April, tho' they then begin to run up to feed; and farmers chuse rather to do this, than to let them hurt their fall-foin, lucerne, clover, &c.

When sheep are fed upon turneps, they must not be suffered to go at large in the field: they would spoil more turneps in a fortnight, than would feed them a whole winter. They are therefore given them three different ways.

The first is, by inclosing a piece with hurdles, proportioned to what they can eat in one day, and the hurdles are removed every morning.

Sheep eat only the leaves and the heart of the turneps, so that great part of them remain in the earth. 'Tis true these fragments of the roots are afterwards pulled out with a fork with iron prongs: but besides that all of them are not pulled up, the sheep do not relish those rinds of turneps which begin to rot, and are tainted with their urine, dung, &c.

The second method differs from the first only in pulling the turneps as far as they are hurdled off, before the sheep are sent in. They then eat them better, because the food is fresh and in good condition. Besides, they are more easily pulled when entire, than when pieces of them remain.

The turneps which grow near the hurdles should be thrown towards the middle of the space hurdled off, because they are less liable to be trodden upon there, than nearer the hurdle, where the sheep run about most in search of means of escaping to the fresh turneps.

The third way consists in pulling the turneps, and carrying them into another field, or laying them on a spot of grass, where the sheep eat them all up. The expence of carrying the turneps, is compensated by saving the price of the hurdles, and the trouble of moving them every day; but the benefit of the dung and urine of the sheep is lost.

This method is necessary when the field on which the turneps grow, is wet: for 1. The sheep would bury and trample upon part of the turneps, which would be lost. 2. In treading that wet earth, they would poach it, and render it unfit for corn. 3. By this means, a field may be dunged, which wants it more than that the turneps grew on.

on. 4. This must necessarily be done, if wheat has been sown in the alleys between the rows of turneps.

Turneps are always carried off the field, when they are intended to fatten the larger sort of cattle.

S E C T. III.

Experiments on Turneps cultivated according to the new Husbandry.

IN 1754, M. de Chateau-vieux sowed turneps on beds, in two rows. They suffered greatly for want of rain, and none of them grew to the size they would have done in a more favourable season. Some of them weighed eight pounds: But their general weight was three or four.

In 1755, M. de Chateau-vieux sowed some beds with one row, some with two, and others with three rows. They were afterwards thinned so that the plants were a foot asunder in the rows. Those sown in one row were the largest, and, in general, the most equal. Some of them weighed 14 pounds, and most of them from seven to eight. In the other rows, they did not weigh so much; but they were in great number. He had not, at the time of his communicating this, repeated his experiments often enough to determine what number of rows on each bed will yield the greatest crop.

He makes the following calculation of the produce of an arpent, sown in single rows, and cultivated according to the new husbandry supposing the turneps to weigh only six pounds each: which is very moderate.

Let a surface of 36 square toises, which is nearly the extent of an arpent*, be formed into beds of four feet wide, which is sufficient for one row of turneps. These beds will be 216 feet long, and consequently will contain that number of turneps planted a foot asunder. Those 216 multiplied by 54, the number of beds, will give 11664 turneps for the product of the arpent, which multiplied by six, the weight of each turnep, will give 69984 pounds for the weight of all the turneps on the arpent. This may be looked upon as a very considerable crop: and he has reason to believe, that in a good year, it will be double what he has here calculated.

In 1755, M. Duhamel sowed turneps in a field, on beds. They

* And equal to almost an acre and a quarter of our measure.

were extremely fine, many of them being 29 inches in circumference.

We shall close this chapter with some directions of Mr. Miller for the general culture of this plant.

“ Turneps, says he, delight in a light, sandy, loamy soil, which must not be rich; for in a rich soil they grow rank and are sticky: but if it be moist, they will thrive the better in summer, especially in fresh land, where they are always sweeter than upon an old worn-out, or a rich soil.

“ The common season for sowing of turneps, is any time from the beginning of June to the middle of August, or a little later; though it is not advisable to sow them much after, because, if the autumn should not prove very mild, they will not have time to apple before winter, nor will the roots of those which are sown after the middle of July grow very large, unless the frost keeps off long in autumn. — Two pounds of seed are full sufficient for an acre of land (sown in broad cast), but one pound is the common allowance*.

“ These seeds should always be sown upon an open spot of ground: for if they are near hedges, walls, buildings, or trees, they will draw up, and be very long topt, but their roots will not grow to any size. They are sown in great plenty in the fields near London, not only for the use of the kitchen, but for food for cattle in winter, when there is a scarcity of other food: and this way it becomes a great improvement to barren sandy lands, particularly in Norfolk, where, by the culture of turneps, many persons have doubled the yearly value of their ground.

“ When the plants have got four or five leaves, they should be hoed to destroy the weeds, and to cut up the plants which are too thick, leaving the remaining ones about six or eight inches asunder, which will be room enough for the plants to stand for the first hoeing; and the sooner this is performed when the plants have four leaves, the better they will thrive: but in the second hoeing, which must be performed about three weeks or a month after the first, they should be cut up, so that the remaining plants may stand fourteen or sixteen inches distance, or more, especially if they are designed for feeding of cattle: for where the plants are allowed a good distance, the roots will be proportionably large: so that what

* Three or four ounces, says Mr. Tull, is the usual quantity to drill.

“is lost in number, will be overgained by their bulk, which is what
“I have often observed. But in places where they are sown for the
“use of the kitchen, they need not be left at a greater distance than
“ten inches or a foot, because large roots are not so generally esteemed
“for the table.

“It is not many years since the practice of sowing turneps for
“feeding cattle, has been in general use. How it happened that
“this improvement should have been so long neglected in every
“part of Europe, is not easy to determine; since it is very plain that
“this piece of husbandry was known to the ancients: for Columella,
“in treating of the several kinds of vegetables, which are proper for
“the field, recommends the cultivating *rapa* in plenty; because,
“says he, those roots which are not wanted for the table, will be
“eaten by the cattle. And yet this plant was not much cultivated
“in the fields till of late years, nor is the true method of cultivating
“turneps yet known, or at least it is not practised, in some of the
“distant counties of England: for in many places the seed is sown
“with barley in the spring, and those plants which come up, and
“live till the barley is cut, produce a little green for the sheep to pick
“up, but never have any roots. In other places, where the turnep
“seed is sown by itself, the method of hoeing them is not understood;
“so that weeds and turneps are permitted to grow together, and
“where the turneps come up thick in patches, they are never thinned;
“so that they draw up to have long leaves, but never can have good
“roots, which is the principal part of the plant, and therefore
“should be chiefly attended to.”

Some very curious farmers, continues Mr. Miller, have of late
cultivated turneps, by sowing the seed in rows, with the drill-plough.
“In some places, the rows are sown three feet asunder, in others
“four, in some five, and some six. The latter has been recom-
“mended by some, as the most proper distance; and although
“the intervals are so large, yet the crop produced on an acre has
“been much greater, than upon the same quantity of land where
“the rows have been but half this distance; and upon all the fields
“which have been tilled, the crops have greatly exceeded those which
“have been hand hoed. The late lord viscount Townshend was at
“the expence of making the trial of these two different methods of
“husbandry, with the greatest care, by equally dividing the same
“field into different lands, which were alternately sown in drills,
“and the intermediate lands in broad cast. The latter were hoed by
hand,

“ hand, in the common method, and the other cultivated by the
 “ hoeing plough; and when the roots were fully grown, his lord-
 “ ship had an equal quantity of land, which had been sown in diffe-
 “ rent methods, measured, and the roots drawn up and weighed;
 “ and those roots which had been cultivated by the plough, were so
 “ much larger than the other, that the crop of one acre weighed a
 “ ton and a half more than that of an acre in the other husbandry.

“ When the turneps are sown in drills, they will require to be
 “ hoed by hand, to sepearate and cut out the plants, where they are
 “ too near together in the rows; as also to cut up the weeds between
 “ the plants, where the plough cannot reach them. If this is care-
 “ fully performed, the plowing of the intervals will encourage the
 “ growth of the roots, by thus stirring of the ground, and make it
 “ much better prepared for the crop of barley, or whatever else is
 “ sown the following spring. This method of culture may be sup-
 “ posed to be more expensive than that commonly practised, by those
 “ unacquainted with it: but those who have made trials of both,
 “ find the horse-hoeing to be much the cheapest, and by far the
 “ best: for the country people who are employed in hand-hoeing
 “ of turneps, are very apt to hurry over their work, so that half the
 “ weeds are left growing, and the plants are seldom singled out so
 “ well as they should be; nor are they curious enough to distinguish
 “ the charlock (which is one of the most common weeds in arable
 “ land) from the turneps*; so that about the middle of September,
 “ it is very common to see the fields of turneps full of the yellow
 “ flowers of the charlock. Now, in the horse-hoeing, all the weeds
 “ in the intervals will be entirely destroyed; so that if a few plants in
 “ the rows of turneps should be overlooked, they may be easily
 “ drawn when they appear visible; and by this method the land
 “ will be sooner and better cleared from weeds.

“ The greatest evil which attends a crop of turneps, is that of
 “ their being destroyed by the fly, which usually happens soon after
 “ the plants come above ground, or while they are in the seed leaf;
 “ for after they have put out their rough leaves pretty strong, they
 “ will be past this danger. This is always in dry weather: so that
 “ if there happens rain when the turneps come up, they will grow
 “ so fast as to be in a few days out of danger of the fly; and it
 “ hath been found, that those which have been sown in drills, have

* See charlock in the article Weeds, p. 105.

“ escaped the fly much better than those sown in broad-cast; but if
 “ foot is sown along the surface of each drill, it will be of great ser-
 “ vice to keep off the fly, and a small quantity of it will be sufficient
 “ for a large field, where the drills only are to be covered.

“ Another danger of the crops being destroyed, is from the cater-
 “ pillars, which very often attack them when they are grown so
 “ large as to have six or eight leaves on a plant. The surest method
 “ of destroying these insects is to turn a large parcel of hungry poultry
 “ early in the morning into the field: they will soon devour the in-
 “ sects, and clear the turneps. To this evil, the turneps which are
 “ sown in drills, are not so much exposed: for as the ground be-
 “ tween the rows will be kept stirred, the plants will be kept grow-
 “ ing; so will be less in danger of suffering from these insects.

“ When the ground is stirred in every part” (as in the new
 husbandry,) “ one plowing will be sufficient after the turneps are
 “ eaten, for the sowing of barley, or any other crop: so that there
 “ will be an advantage in this, when the turneps are kept late on the
 “ ground, as will often be the case, especially when they are culti-
 “ vated for feeding of ewes; because it is often the middle of April
 “ before the ground will be cleared; for the late feed in the spring,
 “ before the natural grass comes up, is the most wanted, where
 “ numbers of sheep or ewes are maintained; and one acre of turneps
 “ will afford more feed than fifty acres of the best pasture at that
 “ season.

“ In Norfolk, and some other countries, they cultivate great quan-
 “ tities of turneps for feeding of black cattle, which turn to great ad-
 “ vantage to their farms; for thereby they procure a good dressing
 “ for their land; so that they have extraordinary good crops of
 “ barley upon those lands, which would not have been worth the
 “ plowing, if it had not been thus husbanded.

“ There have been many receipts for preventing the fly taking
 “ turneps, but few of them deserve notice: therefore I shall only
 “ mention two or three which I have seen tried with success. The
 “ first was steeping the seeds in water with flower of brimstone
 “ mixed, so as to make it strong of the brimstone: another was,
 “ steeping it in water with a quantity of the juice of horse-aloes
 “ mixed: both of which have been found of use. The sowing of
 “ foot, or tobacco-dust over the young plants, as soon as they appear
 “ above ground, has also been found very serviceable: in short,
 “ whatever will add vigour to the young plants, will prevent their

"being destroyed by the fly; for these never attack them, till they
"are stunted in their growth".

A gentleman, remarkable, among many other good qualities, for several excellent improvements which he has made in agriculture, tried with success the following experiment, to preserve turneps from the fly, and the better to secure their growth. He sowed the seed in a nursery, where there was least danger of the slugs or the fly, and where they might easily be watered in case of great drought, to make them grow the quicker. They remained in this nursery, till they were large enough to be transplanted. By this means, he gained some weeks longer, to perfect his fallow, or give a thorough plowing to ground which had borne a crop that season. He transplanted his turneps into the field, and by planting them regularly a foot asunder every way, greatly lessened the expence of hoeing; their regularity making it very easy to destroy the weeds from time to time, as they appeared. If the season is dry, they may be carried from the nursery to the field, in vessels full of very moist earth, as hereafter advised by M. de Chateau-vieux, in his directions for transplanting lucerne.

CHAP. VII.

Of FLAX and HEMP.

FLAX and Hemp require a rich soil, well manured and brought to a fine tilth, and kept as clear from weeds as possibly can be. These plants are of infinite use, and may be cultivated to very great advantage.

When they are raised in the fields after the usual method, they seldom grow very high, nor do their stalks branch out much: but when they are allowed more room, they will rise much higher, and branch out more, especially towards the top. The time for sowing both these plants is the spring. Both of them are so great impoverishers of the ground, that it requires dunging after each year's crop; nor should either of them be sown two years together upon the same land, in the old husbandry. The fenny parts of Lincolnshire, and of the isle of Ely are the most remarkable places in England for the culture of these plants. Betwixt two and three bushels of seed is the usual allowance for an acre of land sown in broad-cast: but Mr. Miller says he has found it, from many repeated experiments, much better to sow the seeds in drills, and when the plants are come up,

up, to hoe them in the same manner as is practised for turneps, leaving the plants of flax at about ten inches distance from each other, and those of hemp a foot or sixteen inches a-part. Great care should be taken to destroy all the weeds, which twice hoeing in dry weather will effect, and be sufficient culture till the plants are ripe.

Flax begins to ripen towards the latter end of August, when care must be taken not to let it grow over ripe. It should therefore be pulled up as soon as the heads begin to grow brown and hang downwards; otherwise the seeds will soon scatter and be lost. If the flax is pulled when it first begins to flower, it will be whiter than when it stands till the seed is ripe; but then the seed will be lost, and the thread made of it, tho' of a fairer colour, will not be so strong as when the plants are suffered to stand longer.

There are two seasons for pulling hemp. The first is usually about the middle of August, when they begin to pull what is called the fimple hemp, which is the male plants: but Mr. Miller thinks it would be much better to defer this a fortnight or three weeks longer, until the male plants have fully shed their dust, without which, the seeds will prove abortive, produce nothing if sown the next year, nor yield any oil.

The second pulling is a little after Michaelmas, when the seeds are ripe. This is commonly called Karle Hemp, and is the female plants, which were left at the time when the male were pulled.

An acre of hemp, on a rich soil, will produce, in the common husbandry, near three quarters of seed, which, together with the unwrought hemp, is worth from six to eight pounds. The quantity of flax seed annually imported into Scotland and Ireland, from the East country, and particularly from Riga, amounts to many thousand pounds sterling, which might be saved the public, by properly encouraging the culture of these plants in the northern colonies of America.

The quantity of food which flax and hemp require, seems to secure their success in the new husbandry. M. Duhamel gives us the following experiments made on them in that method, as a specimen of what may be hereafter expected.

M. de Chateau-vieux divided a field into 12 beds, 53 toises and two feet long, and seven feet wide. The middle of each bed was raised high, that there might be a greater depth of mould under the

plants. The soil was strong; but had been so thoroughly pulverised by plowing, that it was as fine as sand.

On the twentieth of March 1753, he sowed six of these beds with the drill-plough, planting six rows of flax in each bed, and using for that purpose nine pounds of seeds.

The plants came up well, and grew thick: but a frost which happened in April damaged many of them.

On the twenty-sixth of April, he sowed the six other beds in the same manner, with 13 pounds of hemp-seed, which likewise came up thick.

The alleys have been horse-hoed but once, and the plants came on greatly, when they were beat down by hail, which did them considerable damage, tho' they afterwards recovered themselves in some degree. The flax was pulled up on the first of August, and the hemp on the eighteenth.

This accident prevented knowing what the produce of the crop might otherwise have been. The plants were taller than usual, and had many more roots; by which one may judge that they would have yielded a greater quantity of flax and hemp, than in the common way.

Another misfortune which attended them was, that they were very badly steeped: but yet one might easily perceive that their threads will be a great deal stronger by this culture, than when they are raised according to the old method.

It is of very great importance, at the same time that the quantity of the flax is increased, to be able to add to its strength. The linen made of it, will be better and last longer, and consequently prove a considerable saving.

The superior quality of the hemp employed in the cordage of ships, is an object of the utmost importance; for it must be of very great advantage to have ropes of a less diameter be as strong as those of a larger size. With such, the same work may be performed more easily and more readily, and perhaps with fewer hands: probably too, the ropes will be more durable. But all these motives of economy are still vastly inferior to the inestimable advantage of saving the ships, their cargoes, and their crews, which often depends on the strength of their sails and cables. I have only barely mentioned these great objects, continues M. Duhamel, to invite all who have the public good at heart, to make experiments which may tend to the utmost improvement of the culture of these plants. How pleasing is the reflection, that whilst we are providing greater plenty of food for the
the

the sustenance of men, we may likewise contribute to the preservation of lives so useful to the community!

M. de Chateau-vieux observes, that flax does not succeed so well in other years, as when there are frequent showers; and that the year 1754, being very dry, proved extremely unfavourable to it. The flax was very short; but that defect was in some measure compensated by the abundance of the seed, and the fineness of the bark of the plant, which was also stronger than usual.

Hemp succeeded better: it grew this year five or six feet high: its stalks were large, and the bark very thick and strong. The ground sown with it now, was that on which it was usually sown, and never had produced so great a quantity.

In an experiment made in Lower Normandy in 1754, the hemp was short, but extremely fruitful in seed, especially the two outer rows, which had profited most by the hoeings. The middle row was shorter than the other two, and yielded less seed. The frequent rains in the spring, prevented the ground's being so well prepared as it should have been, because it was too wet: but, upon the whole, it seemed pretty evident, that hemp cannot be raised to its proper height without the assistance of some dung.

M. Aimen, from 40 plants of female hemp (commonly called male) raised in the common way, and which might be deemed fine ones, had but half a pound of seed, and the stalks were not more than a quarter of an inch in diameter near the root.

A single plant of the same kind, which grew by itself, the earth being kept in a loose state round it, yielded seven pound and an half of seed. It had many branches, and the stalk was three inches in diameter near the root. 'Tis true the hemp was coarse and woody, and the fibres were interrupted where the branches grew. Those who raise this plant only for the oil of its seed, frequently sow it at proper distances between their kidney beans and other leguminous plants, and it never fails to yield better seed than that which is raised in the common way.

CHAP. VIII. SECT. I.

Of the culture of Sain-foin.

THE French call this plant *sainfoin*, *sain* in their language signifying wholesome, and *foin* hay, because they observe that it agrees exceedingly well with all kinds of cattle. We improperly

perly call it *sainfoin*, and frequently *French grass*, because we owe our first knowledge of it to the French.

If this plant is cultivated according to the new husbandry, its stalks will grow to the length of five feet; and, according to Mr. Tull, one acre of sainfoin will yield as much grass as 30 or 40 acres of common grass.

This great fruitfulness of sainfoin, is owing to the vast quantity of its roots. Its tap-root pierces sometimes fifteen or twenty feet deep into the earth, and sends forth many lateral branches, which extend a great way, especially towards the surface of a good soil.

It is wrong to think, as many do, that sainfoin will not succeed if there is not at a certain depth a bed of gravel, stone, or chalk, to stop the progress of its roots. On the contrary, the deeper the earth is, the more its roots extend, and the stronger and more flourishing is the plant.

As some of its seed will frequently not grow, a small quantity should always be sown first, to try it, as has been directed in regard to wheat.

This plant ought not to be sown above half an inch deep, especially in stiff lands: for the heads of these seeds are so large, and their necks so weak, that if they lie much more than half an inch deep, they are not able to rise through the incumbent mould.

As sainfoin yields but an inconsiderable produce the first years, the farmer, in order to make the more of his land, often sows barley, oats, clover, &c. with it. The barley and oats remaining but a short time on the earth, damage the sainfoin but little: but clover, and other perennial plants, do it great hurt.

In dry years, it frequently happens that when the barley or oats are mowed, no sainfoin yet appears. But on examining nearly, we generally perceive white threads, which shew that the sainfoin has sprouted; but its leaves, which were very small, have been cut off by the mowers.

If the other seeds sown with the sainfoin, come up thick, and grow a-pace, and especially if they are lodged, the sainfoin is generally choaked. This seldom happens if it is sown with the drill-plough: for as it is then drilled by itself, in separate rows, it is less in danger of being choaked by any other plants. It certainly does best when sown quite alone.

When Mr. Tull began to cultivate sainfoin according to his method, he sowed two gallons of seed to an acre. But almost all the feed

seed of an acre or two of ground chancing to perish by its being sown too late, he was agreeably surpris'd at the end of three years, to see some plants of sainfoin of an extraordinary size dispersed here and there, so that there were about four plants in a yard square. This part of his field yielded him double the quantity of grass that the rest of it did, where the seed had not perished, and where the sainfoin was much better than in lands which had been sown in the common way.

Mr. Tull concludes from thence, that it is most profitable to sow sainfoin thin, that the roots of one plant may not hurt those of another: and he thinks that they deceive themselves who sow their sainfoin very thick in hopes of reaping a more plentiful crop: because that by so doing they reduce their sainfoin to the same condition it is in on the hills of Calabria, near Crôto, where it grows naturally without any culture, but so low and stunted, that one would almost wonder what could induce any one to think of cultivating so unpromising a plant as it there seems to be.

Mr. Tull supports his opinion by an observation which it may not be improper to mention. He says, that a field of sainfoin, joining to a piece of land which they were plowing up for corn, was greatly damaged by the plough, which, breaking in upon the sainfoin, tore up several plants: but that this part of the field yielded afterwards more grass than any other.

Mr. Tull thinks a gallon of good seed enough for an acre of land. But this seed should be so distributed, that all the plants may be at equal distances. This cannot be done but with the drill-plough. There is no fear of diminishing the crop, by lessening the number of the plants; for one plant well cultivated will yield above half a pound of hay; and consequently if only 112 plants grow upon a square perch, and yield one with another only a quarter of a pound each, they will produce after the rate of two tun to an acre. One would not expect so considerable a return while the plants are yet small and young: they do not cover the ground, and the field looks as if the greatest part of it lay waste: but when they have attained their full growth, they cover the whole surface. Another advantage arising from the new husbandry is, that if the sainfoin has been sown early, it yields a crop the second year, equal to the third year's crop of that which is sown in the common way.

Mr. Tull draws these conclusions from his experiments. When sainfoin is sown with a design to cultivate it with the horse-hoe; the best

best way is to sow it in two parallel rows, eight inches distant from each other; and to make the alleys forty inches wide, so that from the middle of one furrow, to the middle of another, shall be four feet.

2. If sainfoin is sown with an intention only to hand-hoe it, there should be a space of sixteen inches between each row, and the plants in the rows should be at least eight inches asunder.

3. When sainfoin is sown without any intention of hoeing it, the best way is to drill the rows eight inches asunder, with no greater quantity of seed, than when they are at sixteen inches distance: for each plant ought to have a sufficient space round it, to extend its roots in, and draw its necessary nourishment from, without hurting its neighbouring plants.

Sainfoin thrives best in rich, dry, light soils, and especially if there is a bed of chalk, lime-stone, or gravel, under a considerable depth of mould. In marshy grounds, or in lands which retain water, the roots are chilled, and the plant soon perishes.

Tho' sainfoin is a strong plant, the ground where it is sown ought to be in very fine tilth: for as it immediately shoots out great numbers of roots as soon as it sprouts, the mould ought to be loose, and the staple as deep as possible.

Sainfoin may be sowed at any time: but when it is sown in autumn, the young plants are in danger of being hurt by frosts: if it is sown in summer, it frequently happens that the seed remains long in the earth without sprouting: or if it rises, the drought, usual at that season, stints the young plants. The spring is therefore the most proper season for sowing it, when there is no longer any danger of hard frosts.

By means of the drill-plough, the seed of the sainfoin is dropt into channels which this instrument makes, and is at the same time covered with the proper depth of earth.

It will not be necessary to horse-hoe the alleys between the beds of sainfoin, so often as between those of corn. It will be sufficient to horse-hoe the alternate alleys once a year. By this means, one half of the alleys will be rested each year, on which the hay may be made. Thus the expence will be but trifling, and the sainfoin may last thirty years on the same ground, which, by this frequent stirring, will be the better prepared to receive other grains after the sain-foin.

Sainfoin deserves the utmost attention of the farmer, as being certainly one of the most profitable plants he can cultivate. It will do

do on almost any land; and though it succeeds best in good soils, yet it will grow even on dry barren spots, where scarce any other grass can live, provided the roots are not chilled by a cold clay, or other substance retaining water.

Sainfoin has this farther advantage, that it may be mowed at different degrees of ripeness, with nearly the same profit.

1. It may be mowed before it is in bloom. It is then an admirable food for horned cattle; and when cut thus early, it yields a second crop, which makes ample amends for what was lost by not letting the first come to its full growth. This early cutting is attended with another advantage; viz. that in the beginning of the summer it proves very beneficial to cattle by purging them, which frees them from disorders arising from the winter's cold, or dry food.

2. If the weather be rainy, the sainfoin may be left standing till it is in bloom. It is still excellent fodder for cows. But care must be taken in making it into hay, that the flowers do not drop off, which they are very apt to do: for cattle are so fond of the flowers, that these often induce them to eat the rest of the plant.

3. If the rain continues, the sainfoin may continue standing till some of its seeds are formed. The crop will then be more plentiful: not only because it will have attained its full growth, but likewise because its leaves, being more substantial, diminish less in drying. 'Tis true, it is not then so pleasant for fodder: but horses eat it readily, because they love to feel between their teeth the seeds which now begin to be formed.

Mr. Tull says this fodder is so excellent, that horses need no oats when they are fed with it. He affirms that he kept a team of horses with it a whole year in good plight, without giving them any oats, tho' they were worked hard all the time. He adds, that he fattened sheep with it, in less time than others which were fed with corn. But the hay of this plant can never be so good as when it is cultivated with the horse-hoe: for in the common husbandry, it blossoms almost as soon as it is out of the ground.

4. If the season continues rainy, it would be still more adviseable to let the sainfoin stand, than to run the risque of having it rot upon the ground: for then the seed will ripen, and nearly make up for the loss of the fodder: not only because that seed may be carried to market; but likewise because two bushels of it will go as far in

feeding horses, as three bushels of oats, and cattle in general, as well as poultry, are extremely fond of it. Even the sainfoin that has yielded its seed, may be cut down and dried, and, in times of scarcity of fodder, will be better food for horses and large cattle, than the coarse hay of water-meadows, or any kind of straw.

The manner of making sainfoin hay, is as follows.

In a day or two after the sainfoin has been mowed, it will be dry on the upper side, if the weather is good. The swarths, or mowed rows, should then be turned, not singly, but two and two together: for by thus turning them in pairs, there is a double space of ground betwixt pair and pair, which needs but once raking: whereas, if the swarths were turned singly, that is, all the same way, the ground would require as much raking again.

As soon as both sides of the swarths are a little dry, they should be made up into small cocks, the same day they are turned, if possible: for when it is in cock, a less part of it will be exposed to the injuries of the night, than when it lies scattered upon the field. The sun and dew would exhaust almost all its juices, in this last case, in less than a week's time.

These little cocks of sainfoin may be safely made into larger ones, without waiting for its being so thoroughly dry as common hay is required to be: because common hay, by lying down closer, excludes the air necessary for keeping it sweet; so that if the weather prevents its being frequently mov'd and open'd, it will heat, turn yellow, and be spoil'd; whereas sainfoin, by the less flexibility of its stalks, admitting the air more freely, will remain much longer without any danger of fermenting.

Sainfoin hay is never better than when it has been dried by the wind alone, without the assistance of the sun. A little rain, or a mist, which will turn common hay, clover, and even lucerne black, will do no hurt to sainfoin, which is not really spoil'd, till it rots upon the field.

If the weather threatens rain, and the sainfoin is not yet dry, it may be laid up in cocks, without fear of its heating, provided a large basket, or bushy faggot be set up in the middle of each cock, where it will serve for a vent hole, through which the superfluous moisture of the hay will transpire.

As soon as all danger of its heating is over, these cocks should be made into ricks, and thatched. That which is laid up quite dry,

dry, will come out of the rick of a green colour: that which has heated much in the rick, will look brown.

It requires some experience to know the most proper degree of ripeness at which the seeded sainfoin ought to be cut; for the seed is never all ripe together; some ears blossom before others: every ear begins blossoming at the lower part of it, and so continues gradually to do upward for many days; and before the flower is gone off the top, the bottom of the ear has almost filled the seeds that grow there; so that if we should defer cutting till the top seeds are quite ripe, the lower, which are the best, would shed, and be lost. The best time to cut it, is when the greatest part of the seed is well filled, the first blown ripe, and the last blown beginning to be full. The unripe seeds will ripen after cutting, and be, in all respects, as good as those that were ripe before. Some, for want of observing this, have suffered their seed to stand till it was all ripe, and then it has shed, and been lost in cutting.

Sainfoin should never be cut in the heat of the day, while the sun shines out; for then much, even of the unripe seed, will shed in mowing. The right time for this work, is in the morning or the evening, when the dew has render'd the plants supple.

If the weather is fine and clear, the sainfoin will soon dry sufficiently in the swarths, without turning them: but if any rain has fallen, and there is a necessity for turning them, it should be done very gently, whilst they are moist, and not two together, as in the other hay of sainfoin before it has seeded. If the swarths are turned with the handle of the rake, it is best to raise up the ear-sides first, and let the stub-side rest on the ground in turning: but if it is done with the teeth of the rake, let the stub-side be lifted up, and the ears rested on the earth.

If sainfoin be cocked at all*, the sooner it is done, the better; because if the swarths are dry, much of the seed will be lost in separating them, the ears being entangled together. When moist, the seed sticks fast to the ear; but, when dry, it drops out with the least touch or shaking.

There are two ways of threshing it: the one in field, the other in the barn. The first cannot be done but in very fine weather, and

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* Sometimes it is threshed in the field, without being cocked. In that case, the swarths are only just separated, in the dew of the morning, into parcels of about two feet each, by which means it is sooner dried, than when it lies thicker, as it must do, if made into cocks.

while the sun shines in the middle of the day. The best manner of doing this, is to have a large sheet pegg'd down to the ground, for two men with their flails to thresh on, whilst two other men bring them fresh supplies in a small sheet, and two others clear away the hay that is threshed. The seed is emptied out of the great sheet, and riddled through a large sieve, to separate it from the chaff and broken stalks, after which it is put into sacks, and carried into the barn to be winnowed. Care should be taken not to let the hay be wet, because it would be spoiled.

A very important, and at the same time very difficult article, is the keeping of the seed which is threshed in the field, without having ever been wetted. If it be immediately winnowed, and only a little of it laid amidst a great heap, or put into a sack, it will, in a few days, ferment to such a degree, that the greatest part of it will lose its vegetative quality. During that fermentation, it will be very hot, and smell sour. Spreading it upon a barn-floor, only seven or eight inches thick, will answer no end, unless it be frequently and regularly turned both day and night, until the heating is over: but even this will not make its colour keep so bright as that which is well housed, well dried, and threshed in the winter. This last, laid up unthreshed, will keep without any danger of spoiling, because it does not lie close enough to heat. The best way to preserve the seed threshed in the field, is to lay a layer of straw upon a barn floor, and upon that a thin layer of seed, then another layer of straw, and another layer of seed, and so on alternately. By this means, the seed, mixing with the straw, will be kept cool, and come out in the spring with as green a colour as when it was put in: or it may be preserved in a ventilated granary, as hereafter directed.

The greatest part of the sainfoin that is sown, is spoiled by being indiscreetly fed by cattle. Mr. Full is against feeding it at all the first and second year, or any other year in the spring. He says he has recovered worn-out pieces of sainfoin, by plowing them in alleys three feet wide, and leaving beds of sainfoin of the same breadth alternately between them. The plants, by extending their roots in these new plowed alleys, have recovered their vigor, and yielded good crops of hay. He adds, that sainfoin is observed to enrich whatever ground it is planted on, even tho' a crop be taken off it yearly.

This is confirmed by the author of the *New System of agriculture*, who says; "There is a foreign grass much properer for light lands, than clover: 'tis generally known by the name of *Sf. Foyné*; but
2. "that

“that which I have seen in several parts of Berkshire, Wiltshire, Somersetshire, and many other counties, is a bastard sort, and much inferior to the true *Sr. Foyne*, which may be had, very reasonably, from Dunkirk, or Calais, and is yearly imported in great quantities, and sold in the seed-shops at London and elsewhere.—As to the time of letting it grow, that may, if you please, be five years*, for so long it will continue in its prime perfection; and, running into a large knotty root, does so enrich the ground it grows on, that, after it has borne *saint foyne* five years, it will afford three excellent crops of what corn you please; and so improve itself, by alternate burthens of grass and grain, till it arrives at the utmost perfection which land is capable of reaching.—Nothing is so sweet, nothing so innocent, nothing so nourishing, as this *saint foyne*; but, above all, it is observ’d to increase milk, in quantity, and quality, beyond any grass, yet known.”

We shall now give the substance of a few experiments on the culture of this plant, as related by M. Duhamel.

SECT. II.

Experiments on Sainfoin.

IN 1754, M. Eyma planted lucerne, sainfoin, and clover, the plants 16 inches asunder one way, and 8 feet the other. They yielded him an immense increase. The alleys were horse-hoed after every cutting.

In 1755, a field of 888 square toises planted with sainfoin according to the new husbandry, produced him ten thousand weight of dry hay. M. de Chateau-vieux had 15340 pounds of lucerne off one acre, which he cut five times; but M. Eyma thinks that 14445 pounds, Geneva weight, of sainfoin, which he had at one cutting, is a greater crop than M. de Chateau-vieux’s lucerne; besides the after crop, which indeed was but inconsiderable on account of the drought of the season. He says he cuts his sainfoin three times in good years, and that the two last cuttings produce nearly as much as the first; but he allows that such years are not to be expected often.

M. Eyma.

* Tho’ this author limits the prime perfection of sainfoin to five years, in the common husbandry; it will continue equally flourishing a much longer time, when cultivated according to the new method.

M. Eyma doubts whether the preference be due to sainfoin or to lucerne: but he is confident that either of them, properly cultivated, will produce surprising crops.

He thinks that one row of sainfoin, or lucerne, planted in the middle of a bed three feet wide, will profit more by the different hoeings, and consequently produce more grass, than double or triple rows, tho' these last are planted on larger beds, because the single rows have the earth loosened on each side.

M. Drancourt sowed sainfoin, each plant of which, in 1753, had a head of two feet diameter. They thrive so well that, in 1755, one plant, and that not the largest in the field, produced 23 ounces of hay.

CHAP. IX. SECT. I.

Of the culture of Lucerne.

LUCERNE, or medick, is so generally known, that a particular description of it would be needless. It bears a blue, or rather purplish blossom, which leaves a pod like a screw, in which are the seeds, about the bigness of broad clover, but longer, and more of the kidney-shape.

When the stalks of lucerne are cut, instead of withering, as sainfoin does, they spring out again from the stubs, immediately below where the scythe parted them, and are thereby sooner replenished with new shoots, than sainfoin, which shoots only from the root.

Lucerne grows very quick, and strong. A single plant of it, if let grow without cutting, will form a kind of bush.

It will not, like sainfoin, thrive in any soil: That which it delights in most, is a rich, deep, mellow earth, not over dry. It cannot endure cold rains: and therefore does not succeed well in Switzerland, tho' the inhabitants do all they can to cultivate it, from a persuasion of its being a sovereign remedy for the diseases of horses: it grows but poorly neither in the western parts of France: but in the south of that kingdom, the same field is sometimes mowed five or six times a year, and yields a prodigious quantity of excellent fodder.

"This plant," says Mr. Miller, "hath not yet found so good reception in our country as could be wished, nor is it cultivated

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"In any considerable quantity, tho' it is evident it will succeed well in England, being extremely hardy, and resisting the severest cold of our climate. As a proof of this, continues he, I must beg leave to mention that the seeds which have happened to be scattered upon the ground in autumn, have come up, and the plants have endured the cold of a severe winter, and made very strong shoots.

"About the year 1650, the seeds of this plant were brought over from France, and sown in England: but whether for want of skill in its culture, whereby it did not succeed, or that the people were so fond of going on in their old beaten road, as not to try the experiment whether it would succeed here or not, was the occasion of its being entirely neglected in England, I cannot say: but it is very certain that it was neglected many years, so as to be almost forgotten. However, I hope, before I quit this article, to give such directions for its culture, as will encourage the people of England to make farther trial of this valuable plant, which grows in the greatest heat, and also in very cold countries, with this difference only, that in very hot countries, such as the Spanish West-Indies, &c. where it is the chief fodder for their cattle at this time, they cut it every week; whereas in cold countries it is seldom cut oftner than three or four times a year. And it is very likely, that this plant will be of great service to the inhabitants of Barbadoes, Jamaica, and the other hot islands in the West-Indies, where one of the greatest things they want is fodder for their cattle; since by the account given of this plant by F. Feuille, it thrives exceedingly in the Spanish West-Indies, particularly about Lima, where they cut it every week, and bring it into the market to sell, and is there the only fodder cultivated.

"It is also very common in Languedoc, Provence, and Dauphiné, and all over the banks of the Rhone, where it produces abundantly, and may be mowed five or six times in a year. Horses, mules, oxen and other domestick cattle, love it exceedingly; but above all when it is green, if they are permitted to feed on it, and especially the black cattle, which will feed very kindly upon the dried plant, the excess of which is, by many people, thought to be very dangerous: but it is said to be exceeding good for milch cattle, to promote their quantity of milk; and it is also said to agree with horses the best of all, tho' sheep, goats, and most other cattle, will feed upon it, especially when young.

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"The directions given by all those who have written of the culture of this plant are very imperfect: for most of them order the mixing of this seed with oats or barley (as is practised for clover;) but in this way it seldom comes up well; and, if it does, it will draw up so weak by growing amongst the corn, as not to be recovered under a whole year, if ever it can be brought to its usual strength again.

"Others have directed it to be sown upon a low rich moist soil; which is found to be the worst, next to a clay, of any for this plant; in both which the roots will rot in winter, and in a year or two the whole crop will be destroyed.

"The soil in which this plant is found to succeed best in this country is, a light, dry, loose, sandy land, which should be well plowed and dressed, and the roots of all noxious weeds, such as couch grass, &c. destroyed; otherwise these will over-grow the plants while young, and prevent their progress.

"The best time to sow this seed is about the middle of April, when the weather is settled and fair: for if you plow it when the ground is very wet, or in a rainy season, the seeds will burst and come to nothing (as is often the case with several of the leguminous plants;) therefore you should always observe to sow it in a dry season, and if there happens some rain in about a week or ten days after it is sown, the plants will soon appear above ground.

"The method I would direct for sowing these seeds, is as follows. After having well plowed and harrowed the land very fine, you should make a drill quite a-cross the ground almost half an inch deep, into which the seeds should be scattered very thin: then cover them over a quarter of an inch thick, or somewhat more, with the earth; then proceed to make another drill, about a foot and a half from the former, sowing the seeds therein in the same manner as before, and so proceed through the whole spot of ground, allowing the same distance between row and row, and scatter the seeds very thin in the drills. In this manner, an acre of land will require about six pounds of seed: for when it is sown thicker, if the seeds grows well, the plants will be so close as to spoil each other in a year or two, the heads of them growing to a considerable size, as will also the root, provided they have room.

* We flatter ourselves that M. de Chateau-vieux's directions, and his experiments, will appear in a different light.

“ I have measured the crown of one root which was in my possession, eighteen inches diameter; from which I cut near four hundred shoots at one time, which is an extraordinary increase, and this upon a poor dry gravelly soil, which had not been dunged for many years, but the root was at least ten years old; so that if this crop be well cultivated, it will continue many years*, and be equally good as when it was first sown: for the roots generally run down very deep in the ground, provided the soil be dry; and although they should meet a hard gravel a foot below the surface, yet their roots would penetrate it, and make their way downwards, as I have experienced, having taken up some of them which were above a yard in length, and had run two feet into a rock of gravel, so hard as not to be loosened without mattocks and crows of iron, and that with much difficulty.

“ The reason for directing this seed to be sown in rows is, that the plants may have room to grow; and for the better stirring the ground between them, to destroy the weeds, and encourage the growth of the plants, which may be very easily effected with a Dutch hoe, just after the cutting the crop each time, which will cause the plants to shoot again in a very little time, and be much stronger than in such places where the ground cannot be stirred: but when the plants first come up, the ground between should be hoed with a common hoe; and if in doing of this you cut up the plants where they are too thick, it will cause the remaining to be much stronger. This hoeing should be repeated two or three times while the plants are young, according as the weeds are produced, observing always to do it in dry weather, that the weeds may the better be destroyed; for if it be done in moist weather, they will root and grow again.

“ With this management, the plants will grow to the height of two feet, or more, by the beginning of August, when the flowers will begin to appear, at which time the lucerne should be cut, observing to do it in a dry season, if it is to be made hay, and keep it often turned, that it may soon dry, and be carried off the ground; for if it lie long upon the roots, it will prevent their shooting again. After the crop is taken off, you should stir

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* M. Duhamel likewise says, that it will continue a long time on the same ground, if care be taken that the natural grass or weeds do not choke it; for as soon as any other plants come up amongst lucerne, it decays gradually and dies, so that very little of it will remain at the end of a few years.

the ground between the rows with a hoe, to kill the weeds, and loosen the surface, which will cause the plants to shoot out again in a short time, so that by the beginning of September there will be shoots four or five inches high, when you may turn in sheep upon it to feed it down: nor should the shoots be suffered to remain upon the plants, which would decay when the frosty weather comes on, and fall down upon the crown of the roots, and prevent their shooting early the succeeding spring.

The best way therefore is to feed it until November, when it will have done shooting for that season: but it should not be fed by large cattle the first year, because the roots, being young, would be in danger of being destroyed, either by their trampling upon them, or their pulling them out of the ground: but sheep will be of service to the roots by dunging the ground, provided they do not eat it too close, so as to endanger the crown of the roots.

In the beginning of February, the ground between the rows should be again stirred with the hoe, to encourage them to shoot again: but in doing of this you should be careful not to injure the crown of the roots, upon which the buds are at that time very turgid, and ready to push. With this management, if the soil be warm, by the middle of March the shoots will be five or six inches high, when, if you are in want of fodder, you may feed it down till a week in April; after which it should be suffered to grow for a crop, which will be fit to cut in the beginning of June, when you should observe to get it off the ground as soon as possible, and stir the ground again with the Dutch hoe, which will forward the plants shooting again, so that by the middle, or latter end of July, there will be another crop fit to cut, which must be managed as before; after which it should be fed down again in autumn: and as the roots by this time will have taken deep hold in the ground, there will be little danger of hurting them, if you should turn in larger cattle; but you must always observe not to suffer them to remain after the roots have done shooting, lest they should eat down the crown of the roots below the buds, which would considerably damage, if not destroy them.

In this manner you may continue constantly to have two crops to cut, and two feedings upon this plant, and in good seasons there may be three crops cut, and two feedings, which will be a great

“ great improvement, especially as this plant will grow upon dry
 “ barren soils, where grass will come to little; and be of great use
 “ in dry summers, when grass is often burnt up: and as it is an
 “ early plant in the spring, so it will be of great service when fod-
 “ der falls short at that season, when it will be fit to feed at least a
 “ month before grass or clover; for I have had this plant eight
 “ inches high by the tenth of March, old style, at which time
 “ the grass in the same place has scarcely been one inch high.

“ That cold would not injure this plant, I am fully satisfied*;
 “ for in the very cold winter, Anno 1728—9, I had some roots of
 “ this plant which were dug up in October, and laid upon the
 “ ground in the open air till the beginning of March, when I
 “ planted them again, and they shot out very vigorously soon af-
 “ ter: nay, even while they lay upon the ground, they struck out
 “ fibres from the under side of the roots, and had begun to shoot
 “ green from the crown of the roots. But that wet will destroy
 “ the roots, I am fully convinced; for I sowed a little of the seed
 “ upon a moist spot of ground for a trial, which came up very
 “ well, and flourished exceedingly during the summer season, but
 “ in winter, when the great rains fell, the roots began to rot at bot-
 “ tom, and before the spring most of them were destroyed.

“ The best places to procure the seed from, are Switzerland and
 “ the northern parts of France, which succeeds better with us, than
 “ that which comes from a more southern climate; but this seed
 “ may be saved in England in great plenty; in order to which, a
 “ small quantity of the plants should be suffered to grow uncut till
 “ the seeds are ripe, when they must be cut, and laid to dry in an
 “ open barn where the air may freely pass through: but the seed
 “ must be defended from the wet; for if it be exposed thereto, it
 “ will shoot while it remains in the pod, whereby it will be spoiled.
 “ When it is quite dry, it must be threshed out, and cleansed from
 “ the husk, and preserved in a dry place till the season for sowing
 “ it: and this seed saved in England is much preferable to any
 “ brought from abroad, as I have several times experienced, the
 “ plants produced from it having been much stronger than those
 “ produced from French, Helvetian, and Turkey seeds, which
 “ were sown at the same time, and on the same soil and situation.

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* This is confirm'd by M. Duhamel, who says, that the hard winter in 1709, which killed almost all the olive and walnut-trees in France, did no great damage to the lucerne.

"I am inclinable to think that the reason of this plant not succeeding, when it has been sown in England, has either been occasioned by the sowing it with corn, with which it will by no means thrive* (for though the plant be very hardy when grown pretty large, yet at its first coming up, if it be incommoded by any other plants or weeds, it seldom does well; therefore it should always be sown by itself, and carefully cleared from weeds until it has strength, after which it is not easily destroyed;) or, perhaps, people have sown it at a wrong season, or in wet weather, whereby the seeds have rotted, and never come up, which hath discouraged their attempting it again: but however the success has been, I dare aver, that if the method of sowing or managing of this plant, which is here laid down, be duly followed, it will be found to thrive as well as any other sort of fodder now cultivated in England, and will continue much longer: for if the ground be duly stirred after the cutting each crop, and the first crop fed, as hath been directed, the plants will continue in vigour twenty years, or more, without renewing, provided they are not permitted to seed, which would weaken the roots more than four times cutting would do.

"The hay of this plant should be kept in close barns, it being too tender to be kept in ricks open to the air as other hay: but it will remain good, if well dried before it be carried in, three years. The people abroad, reckon an acre of this fodder sufficient to keep three horses all the year round: and I have been assured by persons of undoubted credit, who have cultivated this plant in England, that three acres of it have fed ten cart horses from the end of April to the beginning of October, without any other food, though they have been constantly worked. Indeed the best use that can be made of this grass is, to cut it, and give it green to the cattle. Where this hath been daily practised, I have observed that by the time the field has been cut over, that part which was the first cut, hath been ready to cut again; so that there has been a constant supply in the same field, from the middle of April to the end of October, when the season has continued long mild; and when the summers have proved showery, I have known six crops cut in one season: but in the dry seasons there will be always three. When the plant begins to flower, it should then be cut; for if it stands longer, the stalks will grow

* M. Duhamel also is absolutely against sowing it with corn, or any other plant.

“grow hard, and the under-leaves will decay, and then the cattle
 “will not so readily eat it. Where there is a quantity of this culti-
 “vated, some of it should be cut before the flowers appear, other-
 “wise there will be too much to cut within a proper time.
 “When Lucerne is made into hay, it will require a great deal of
 “making: for as the stalks are very succulent, it must be often
 “turned, and exposed a fortnight before it will be fit to house; for
 “this requires a longer time to make than sainfoin: therefore,
 “when it is cut, it should be carried to make upon some grass
 “ground; because the earth in the intervals of the rows will wash
 “up and mix with the hay in every shower of rain; and by car-
 “rying it off as soon as it is cut, the plants will shoot up again
 “soon: but it is not so profitable for hay, as to cut green for all
 “sorts of cattle, but especially horses, which are extremely fond of
 “it; and to them it will answer the purpose of both hay and corn,
 “and they may be worked at the same time just as much as when
 “they are fed with corn, or dry food.”

To the instructions which Mr. Miller has here given for the ma-
 nagement of lucerne, we shall only add a few remarks of M. Du-
 hamel, and then proceed to the experiments which some of his
 correspondents, and particularly M. de Chateau-vieux, have made
 upon the culture of this plant, according to the principles of the
 new husbandry.

Lucerne, like sainfoin, may be cut, either before, or while it is
 in bloom, or when the seed is ripe. The only things to be ob-
 served are.

1. That it makes the best fodder, when cut before its lateral
 shoots come out, and consequently a good while before it blossoms.
2. That the earlier it is cut, the sooner it produces a new crop.
3. That lucerne requires more time to dry it into hay, than sain-
 foin: but yet it must not be left long upon the field, lest it should
 heat, and damage the young shoots rising for another crop.
4. That rain hurts lucerne, when cut, more than it does sainfoin.
 It should therefore be housed as soon as it is dry: for this hay can-
 not be pressed so close together, in coeks, but that the water will
 penetrate into it, and rot it.
5. If lucerne grows yellow before it is in bloom, it is an almost
 certain sign that its root is attacked by some insect in the earth.
 The best way in this case is, to cut it down, that the grass may not
 be

be lost, and that the insects may be destroyed before they entirely consume the root.

6. When the seed is to be sowed, it must stand till it is quite ripe, and that crop of grass is lost.

When the seed is quite ripe, the tops of the plants, where the pods grow, should be cut off with a sharp sickle, (shaking them as little as possible,) and laid in a cloth held ready to receive them, on which they are dried in the shade, and then beat out and cleaned. The rest of the grass is afterwards cut down, rather to clear the field, than for any use it can be of, being now too coarse and hard.

CHAP. IX. SECT. II.

Experiments on Lucerne cultivated according to the new husbandry, by
M. DE CHATEAU-VIEUX.

"IT is truly with regret, says M. de Chateau-vieux, that I am forced to treat a subject of this importance, in so summary a way, as the limits of this letter * require. However, I hope that even this general account of my experiments may be a guide to those who would cultivate this plant. Many persons who live at a considerable distance from this place †, have already followed my example, and are extremely well satisfied with their success.

"Though I agree with M. Duhamel, and the other partisans of the new husbandry, that lucerne and sainfoin thrive best when cultivated in beds; yet my practice differs, in many respects, from theirs. This difference consists in,

1. The principle which I apply particularly to the culture of Lucerne.

"LUCERNE naturally grows with one large perpendicular root, which penetrates very deep into the earth, and has few, if any, lateral roots. From similar experiments on other tap-rooted plants, I was induced to think, that this too, by transplanting it, and at the same time cutting off part of its tap-root, might be made to shoot out several horizontal roots, which, reaching into the loose mould of the alleys, and extending themselves there, would collect a greater quantity of nourishment for the plant, and consequently enable it to produce more abundant crops.

"The event has proved, that when we reason upon sound principles, we

* His letter to M. Duhamel. † Geneva.

we seldom err. My transplanted lucerne pushed out numbers of large lateral roots, and these branched out again into others, which may be multiplied without end by frequent culture of the alleys: for the horse-hoe has the same effect on these horizontal roots, as cutting has upon the tap-root.

2. *The method of transplanting the Lucerne.*

"I Made several beds, some about three feet wide, (including the alleys,) into which I transplanted a single row of lucerne; others about three feet nine inches, into which I transplanted two rows; and others about four feet three inches wide, in which I put three rows. The design of this variation was, to see by which of these three methods the same extent of ground will produce the greatest quantity of lucerne. I believe it will require five or six years to determine exactly which of them will be best; because, as the plants increase every year in bulk, their produce alters, and may perhaps not keep in proportion to the first years, though probably the difference will not be great. But without waiting so long, I can already see, that *the crop will be greatest by planting only one row on each bed.*

"The plants in the single rows were six inches asunder, nor should they ever be nearer; and those in the double and triple rows, were eight or nine inches distant from each other. I must observe, that I likewise sowed lucerne with the drill, in beds, in which it has remained without transplanting. It is very fine, but not near so strong and flourishing as that which I transplanted. When lucerne is sown where it is to remain, it necessarily requires being thinned, and that operation takes up more time than transplanting it would do."

Rules to be observed in transplanting Lucerne into beds.

1. **T**HE middle of the beds must be raised and arched as high as possible, and as the lucerne is to remain several years on the same ground, no pains should be spared to prepare the earth as well as can be.

2. Lucerne should be sown in the spring, and in a rich mould, that the plants may be strong enough to transplant in September.

3. Plants two or three years old, may be transplanted equally well.

4. They

4. They should be transplanted in September, that they may have time to take fresh root before the winter comes on.

5. If they cannot conveniently be transplanted in September, it may be done in October, provided it does not freeze.

6. The mould into which they are transplanted should be moist; and if the weather be somewhat rainy, it is so much the better. In this case, I have never found it necessary to water the plants.

7. If lucerne is transplanted in November or December, there is danger of the frosts forcing many of the plants out of the ground.

8. If too warm and dry a season prevents transplanting in September or October, it is best to stay till the winter is past. The plants will then be sure of taking root, and very few of them will fail.

9. If they can be transplanted in autumn, they will yield pretty good crops the next year: but if they are not transplanted till spring, the next year's crop will be but indifferent.

10. The plants must be taken up out of the nursery with great care and patience, that their roots may not be damaged.

11. The plants should be left about six or seven inches long, and the green tops should be cut off within about two inches of the crown of the root.

12. The plants will take root the sooner, if they are put in water as soon as they are taken up, and kept in it till they are planted.

13. They are planted in holes made with a planting stick, in the same manner as cabbages or lettices are planted in a garden.

14. The best way of planting lucerne is, to cut a strait channel two or three inches deep, and set the plants in the bottom of it, covering them up to the neck.

15. Great care should be taken not to suffer any weeds to grow among the lucerne, at least for the two or three first years. To this end, the rows should be weeded by hand, as well as the edge of the alleys near the plants, where the horse-hoe cannot go.

16. The alleys may be stirred, either with the single cultivator, or the cultivator with two mould boards, which, at the same time that it destroys the weeds, keeps the mould loose.

17. The first stirring may be given with the single cultivator, with which a furrow may be cut on each side of the main furrow in the middle of the alleys, by which means the earth will be turned over on both sides of it.

18. The

18. The second stirring may be given with the cultivator with two mould-boards, by drawing it along the middle of the alleys. This will turn the earth towards the rows. By these alternate stirrings, the alleys will be constantly kept in a loose state.

19. This culture is so easily performed, and in so short a time, that it may be repeated frequently. In this I differ from M. Duhamel, who orders it but seldom. My opinion is, that the alleys should be stirred once a month, during the whole time that the lucerne is in a growing state.

20. If the alleys keep free from weeds, less stirring them may do; but the mould should never be suffered to grow too hard.

21. As soon as some of the plants begin to blossom, the lucerne should be cut. It will then make excellent fodder, superior to every other kind.

22. The lucerne hay should be dried as quick as possible, and frequently turned. The less it is exposed to the heat of the sun, the better fodder it makes.

23. Lucerne must not be housed till it is dry: but at the same time care must be taken that it be not too dry: for then, many of the leaves will fall off, as they dry sooner than the stalks.

24. Cattle must not have too much given them at a time, till they are accustomed to it.

25. No cattle should ever be suffered to feed on the beds of lucerne. If the earth is very dry, towards the latter end of the autumn, sheep will do it the least hurt. If the plants are then tall enough to be mowed, the best way is to cut them, and give them green to the cattle.

These rules contain all that is essentially necessary for making and keeping in good order this kind of artificial pasture. I can safely say, that whoever tries them, will be abundantly rewarded for his trouble and expence. Sainfoin may be cultivated in the same manner.

Account of the produce of Lucerne planted in beds, and cultivated according to the principles of the new husbandry; with some important reflections on the advantages which may be obtained from it, by M. de Chateau-vieux.

NO judgment should be formed of what lucerne may produce, by the crops of the first or second year: it is then too young to be able to yield much. If we were to calculate even by its third

year's produce, we should still consider, that as the plants increase every year in bulk and vigour, (and where they will stop I am not yet able to determine,) the produce will be proportioned to that increase, and consequently the crop of each succeeding year will be greater than that of the last. The crops I am going to speak of, are those of the second and third year: but my calculations will be made on that of the third year. It is proper to remember, that the years 1753 and 1754, were uncommonly dry, inasmuch that sometimes, not a drop of rain, nor scarce any dew, fell between the cutting of one crop and that of another. The seasons were so unfavourable to the productions of grass, that hay rose to an excessive price.

I shall first say what was the state of the plants in their third year, and afterwards how much hay they yielded.

State of the plants in their third year.

As the part of the plant which I now consider, is that which is buried in the earth, I uncovered numbers of them, that I might be able to judge of their general state. I was greatly struck with the effect which transplanting had had upon them. Instead of one perpendicular root, which they usually have, all these plants had three, four, five, and sometimes more, almost equally big roots. They were, in general, three quarters of an inch in diameter, and proceeded from the original root, which was now at least an inch in diameter, and in many of the plants an inch and a half. After the most careful search which I could possibly make, I could not find one plant of lucerne sown in the common way, tho' it had stood twelve, twenty or more years, whose tap-root had grown to the bigness of an inch diameter: few of them were above half, or at most three quarters of an inch thick. This difference is very great.

I likewise found that the roots of the transplanted lucerne had produced another kind of roots, of which I saw none about the roots of the old lucerne. These were a great number of fibrous roots, some of which were already one-twelfth of an inch in diameter, and looked as if they would also become principal roots.

The stalks seem to rise out of the earth; and from the first time of cutting them, a kind of head forms just above ground, which extends itself every year. The first year this head was two or three inches wide: the second year, it was generally about six inches over; and this third year, almost half the plants have a crown ten or twelve inches

inches in diameter, and as many of them have grown so as to touch one another, their crowns are become of an oval form, having extended themselves on the sides where they met with no resistance.

C R O P S.

"I Have an arpent of lucerne in beds, divided into two parts. This is the third crop of lucerne off one of them. The beds are 250 feet long. In 1753, I cut this lucerne six times, viz. in May, June, July, August, September, and the beginning of November. This last cutting was not near so plentiful as the others, and I dried it within doors.

"These six cuttings off one bed, on which there was but one row of lucerne, yielded 140 pounds of well dried hay.

"In 1754, the lucerne was late before it began to shoot, and the earth was drier than the year before. I had but five crops: the first was cut on the 27th of May, the second, on the 1st of July, the third, on the 27th of July, the fourth, on the 26th of August, and the fifth, on the 23d of October. These five cuttings yielded in all 225 pounds of well dried hay off each bed.

"A field 250 feet long, which was the length of my beds, and 210 feet wide, contains an arpent. This arpent divided into 68 beds, each three feet wide, producing after the rate of 225 pounds of hay off each bed, would yield in all 15300 pounds*, which is infinitely more than is ever obtained in the common way.

"The beds with three rows yielded much less. The third year, their crops amounted to no more than 169 pounds off each bed, which is a fourth less than the others; and as these beds are wider, instead of having 68, as in the former disposition of the arpent, there will be only 47, each four feet three inches wide, the total produce of which will be but 7943 pounds: consequently this arpent will yield little more than half as much as an arpent laid out in beds three feet wide, planted with only single rows.

Remarks, by M. de Chateau-vieux.

"THE plants of lucerne had the fate of all kinds of plantations: that is to say, some of them were more vigorous than others. The greatest number of these plants produced each of them a pound of dry hay, and some of them yielded two pounds. I look upon

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* Upwards of seven and a half loads of hay, at 18 hundred weight to the load, equal to above six loads on an English acre.

these last as such extraordinary productions, that I do not expect many of them to yield the like quantity again. I think one may be very well satisfied, if the plants, one with another, yield a pound of hay a-piece every year. This is nearly the result of my experiment on beds which had but one row; and the produce of these would have been still greater, if many of my plants had not failed: in the room of which I set young ones, which could not acquire sufficient strength to yield full crops.

In these experiments, I have employed no dung: neither have I for any of my corn fields. I have reserved it for improving my pastures and meadows; and intend next to apply it to my lucerne, which, I doubt not, will be much the finer for it. The only thing now remaining is, to know by experience which will be the best way of using it. I have some thoughts on that head, which may render it much more profitable.

Lucerne deserves to be cultivated with care: not only on account of the great quantity of fodder which it yields, but likewise because the quality of its hay is superior to any other. The new husbandry will render it still more perfect. Plants cultivated this way, enjoy the benefit of a free circulation of the air, and that circulation keeps them sweet and sound, and free from all mustiness towards their roots: for, being open to the rays of the sun, that great source of kindly vegetation, they attain great perfection in all their parts, both as to their substance, and their flavour. Cattle eat this food greedily, and are better nourished with it, than with any other: but as every excess is bad, too great a quantity should not be given them at once, especially at first, lest it should swell them. The best way is, to bring them to it by degrees.

I have experienced these qualities in this hay, by comparing it with every other sort. The excellence of this, justifies the principles on which the new husbandry is founded. I have offered to my horses bundles of every kind of hay, and at the same time a bundle of this hay of lucerne. They have not hesitated a moment to prefer the latter. Nothing but its superior qualities could determine them in this choice, which has never varied, and has always been in favour of the lucerne cultivated in this manner.

It would be lavishing this excellent fodder, to feed horses entirely with it. It need only be given them by turns with common hay; which will be a great saving: for this lucerne will supply the place of oats. I am certain that *my horses fed partly with this hay,*

and without oats, will be in better plight, stronger, and more vigorous, than those which are fed with meadow hay and corn in the usual way. It is now some time since I have fed my coach horses with it, and have retrenched their oats. Instead of this last food, and at the hours they used to have it, I gave them lucerne chopt, as the Spaniards do straw to their horses. Mine are as fond of it, and shew the same impatience to find it in their manger, as if it was oats; and since their being put under this diet, they are in better condition than before, and so mettlesome that the coachman has enough to do to keep them in.

“When I said that retrenching the oats would be a considerable saving, I did not so much mean the saving of the expence of that corn, as the better improving of many vast tracts of land which are sown with oats, and might, with proper management, produce much more useful, and more profitable sorts of grain, notwithstanding the too general prejudice, that some lands are not capable of bearing any better. For my part, I am thoroughly satisfied, that whatever ground can bear a crop of oats, can likewise, under the new husbandry, bear any other grain.

Continuation of M. de Chateau-vieux's account of his experiments on Lucerne, in the years 1755 and 1756.

“THE great drought of the year 1755, was accompanied with great heat; and the year 1756 was very rainy, and moderately warm, there being but very few hot days in it.

“The lucerne was exposed to a most severe winter in 1755, when the frost was excessive hard, and lasted very long. M. de Reaumur's thermometer was some days, at different times, 8, 9, 10, 12, and 13 degrees below the freezing point; and on the 3d of February, a thermometer in the open air, stood at 16 degrees * below freezing. These severe frosts made me uneasy for my lucerne, which however bore them, without receiving any damage.

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* The greatest cold in the winter of the year 1739-40, sunk Fahrenheit's thermometer to about 12 degrees, equal to 11 degrees below the freezing point of M. de Reaumur's thermometer. The 16th degree below the freezing point of M. de Reaumur's thermometer, answers to nearly the 3d degree of Fahrenheit's: consequently the cold was, by Fahrenheit's thermometer, 9 degrees greater in Switzerland in 1755, than it was here in the severest frost of the very hard winter in 1739-40: and therefore, as M. de Chateau-vieux's lucerne was not hurt by that intense cold, there can be no fear of this plant's being killed by any inclemency of the weather in this country.

"The rains in 1756 did no hurt to the plants; but they prevented my cutting them at proper times. I had but four crops of lucerne this year, being obliged to wait for an appearance of fine weather to dry it in, before I could venture to cut it down. These rains likewise hindered my giving the proper hoeings to the alleys, which were full of weeds during the summer and autumn. I chose rather to leave them in that condition, than attempt to hoe them while the ground was over wet: not doubting but the spring hoeings would easily destroy those weeds.

"In 1755, I cut my lucerne five times: the first was, on the 3d of May, before any flowers appeared: the second, on the 12th of June: the third, on the 15th of July: the fourth, on the 21st of August; and the fifth, on the 7th of October. I was obliged to finish the drying of this last cutting, in barns and under cover.

"In 1756, which was the fifth year of these plants, I cut them but four times: the first, on the 3d of June; the second, on the 1st of July: the third, on the 4th of August; and the fourth, on the 27th of September.

A bed 250 feet long, with only one row of lucerne,

Yielded	{	In 1754	225	} pounds of dry hay.
		1755	197	
		1756	281	

In three years, 703 pounds.

A bed of the same length, with three rows of lucerne,

Yielded	{	In 1754	169	} pounds of dry hay.
		1755	180	
		1756	226	

In three years, 575 pounds.

Observations, by M. de Chateau-vieux.

WE see, by the above account of three years, that a piece of ground laid out in narrow beds, planted with only one row of lucerne, yielded a greater produce than the same extent made into wider beds, and planted with three rows.

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I shall not, however, pretend to determine from this one experiment, that it is best to lay down large fields in this manner. I think it will be right to try first, whether the success will be the same on different soils, and likewise on lands whose exposition may be more or less advantageous. If, after repeated trials, the beds which have but one row of plants, yield the greatest quantity of hay, that method is certainly to be preferred. To clear up this point, still more to my satisfaction, I continue to plant lucerne in beds, some with one, and others with three rows.

“The difference between the crop of 1756, and those of the two preceding years, would induce one to think that rainy seasons are best for the production of hay: but still the greater quantity which the year 1756 produced, must not be imputed to the rain only: we should likewise consider, that the plants had thrived greatly since 1754: that their stems were grown much larger, and their roots much stronger and more numerous, and that they were consequently able to yield much greater crops than before. They have abundantly answered my expectation, both as to quantity and quality.

“With respect to the quantity, it is much greater than that of any common fodder: I mean, of any that the same extent of ground would have produced, if cultivated in the common way; though it would then have been covered with an immense quantity of plants. This is a fact, which numbers of experiments prove, and which we shall cease to wonder at when we consider the great effects of the frequent stirring of the alleys. To this it is that I owe the repetition of my crops, and their being all of nearly equal goodness. I do not exaggerate, when I say, that every summer month, which is the time I generally allow between each cutting, will produce shoots two feet long, and sometimes more: and supposing that I cut them but five times a year, each plant will have produced after the rate of nine or ten feet length of shoots, and that in the same time that most meadows will not produce grass above two feet long.

“As to the quality of this hay, I continue to prefer it to all other fodder. My experience has confirmed what I said of it in 1754: and I shall only add, that I have since found, that it is as good at the end of four years, as when it is first cut. If there was any difference, horses would soon be sensible of it: but they eat of either without distinction.

“I feed my horses with it, chiefly in the summer, at which time they do most work, and am more and more sensible of the advantages

vantages of it. Five or six pounds of lucerne a day, are sufficient for a middle sized horse: but the quantity may be increased or diminished, according as the horse is nourished by it; for in that there is great difference.

WE shall conclude this article with some experiments on the culture of this plant, communicated to Mess. de Chateau-vieux and Duhamel, by different persons, and with an experiment made by M. Duhamel himself.

In April 1753, M. Diancourt sowed lucerne in rows, of which many plants produced an ounce of hay a piece in September following. In June 1754, the same plants yielded 12 ounces and a half each. He reckoned that, one with another, each plant had afforded him a pound of hay, which is a very great crop. On an arpent sown in double rows, he had 26400 plants*; and on another sown in single rows, 15400†: but whether the plants in the single rows were so much larger and more vigorous, as to compensate for the greater number in the double rows, was what he could not determine at the time of his communicating this.

M. de Pontbriant of Rennes in Britany, rightly judging that one of the most essential services he could do his country, would be the improving the pasture of that province, which is famous for the production of cattle: planted lucerne, to shew the people how small a space of ground, and that too cultivated by the very cattle which are fed upon it, will produce a greater quantity of much better fodder, than all the grass which their vast commons and extensive pastures yield them.

In September 1755, he transplanted lucerne from a field which was to be fallowed. The roots of the plants were three or four feet long. He planted them in beds six feet distant, and the plants eight or ten inches asunder, in a field which he thought free from weeds. In this he was mistaken: for, though the lucerne made very good shoots, yet, by neglecting to hoe the alleys, weeds came up, and over-run the ground.

He mowed the whole, then horse-hoed it, and planted a new row of

* A pound of dry hay from each of these plants, would amount to upwards of 13 loads of hay; equal to ten and a half loads on an English acre.

† At the same rate, these would produce about 7 loads and a half, at 18 hundred weight to the load.

of lucerne between each of the former rows; and expects that next year will yield him several good crops; which M. Duhamel thinks he may depend on, if he can but get the better of the weeds.

A gentleman at Montellmart in Dauphiny, writes as follows to M. de Chateau-vieux.

"In the autumn, I transplanted from a spot of lucerne three years old, as many plants, as were requisite for a space of 48 square toises made into beds. The middle of the beds was raised very high, and I planted only a single row in each. The first cutting yielded me one truss of hay; the second, four; the third, six. The shoots of the last cutting were pretty tall, and seemed to be wanting only in number: that, without doubt, will come by and bye, when the roots shall have multiplied and grown stronger. I hope that the heat of this climate will not stop their growth: for I take care to stir the alleys as often as the lucerne is cut.

"A little later in the season, I planted 220 toises more with lucerne, which I watered, because the weather was cold and dry. The plants succeeded very well, excepting a few which died. The first cutting was very weak, the second, middling; and the third is now growing, it being but 17 days since the last was cut. Several of the shoots are already 18 inches long. I have not yet dunged any of these beds: but I intend to dung them all next winter, in order to quicken the growth of the plants, and give them greater strength."

The same gentleman writes again to M. de Chateau-vieux, the 12th of September, 1755, to the following effect.

"I have already cut my lucerne in the new way, five times, and hope to have a sixth cutting towards the end of this month. As the drought does not cripple my plants, but only retards their growth for about a week, I cut them at the end of 25 days, when they were in full bloom: whereas, in this season, they require at least a month. The stalks are full as strong, and the leaves as large, as those of lucerne which are well dunged, and plentifully watered every fortnight. The only inconvenience I find, and that not a great one, is, that this lucerne is difficult to mow*, because

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* This inconvenience, says M. de Chateau-vieux, is but a small hindrance. I mow my lucerne, and it stands the scythe very well, especially the second year. A few stalks which may escape the scythe, are of little consequence; and expert workmen will leave but few, even of them. I have a plantation of lucerne which is always cut with a sickle, though it would very well bear the scythe. This I do, that, by losing none, I may be able to judge the more exactly of its produce.

“ the stalks do not stand to the scythe, and many of them trail upon
 “ the ground. This year, I have used a sickle: but it does not dis-
 “ patch the work so quickly as a scythe. Perhaps stirring of the
 “ alleys with the cultivator and plough, (neither of which I have
 “ used this year,) to clear the ground of weeds and loosen the
 “ mould, may help to strengthen the stalks: and as they grow
 “ thicker every year, they will be better able to bear the scythe. I
 “ have prepared a great deal more ground, to enlarge my plantations
 “ of lucerne. The drought stops me for the present; but as soon as
 “ rain shall have moistened the earth, I intend immediately to plant
 “ a surface of seven or eight hundred toises.”

The following letter to M. de Chateau-vieux, is dated from Chateau-Gaillard in the upper Bugey, near Lyons, June 6, 1755.

“ Lucerne which I sowed last March, observing your directions in
 “ the culture of it, is now two feet high; which plainly shews me,
 “ that I shall be able to cut it six times next year. Some of my
 “ neighbours have sowed lucerne, mixed with oats, in a better soil
 “ than mine; but without horse-hoeing it, or stirring the ground
 “ between the plants. It is now but two inches high, and is in
 “ danger of being destroyed by the drought, which mine is not.”

A letter from the same, dated July the 5th, 1755, says,

“ On the 20th of June, I cut my lucerne which was sown in
 “ March. It was three feet high when I cut it, and has already made
 “ fresh shoots thirteen or fourteen inches long. I have let some of
 “ it stand, which will produce good seed. This will afford me an
 “ opportunity of convincing the most incredulous, of the superior
 “ excellence of the new husbandry.

This lucerne, after having been cut a second time, was two feet high on the 17th of August; whilst that sown in the old way, and mixed with oats, had not been cut at all, and was but four inches high.

M. Duhamel himself, in the autumn of 1755, took up the roots of an old field of lucerne, which were about the thickness of a man's thumb, and six or seven inches long, and replanted them in trenches. All his husbandmen told him that they were worn out, and too old to shoot again: but yet not one of them failed. They yielded three cuttings the first year, tho' the soil was by no means proper for them. As there still remained some rows which could not be transplanted in the autumn, he removed them the next spring. Many of these plants perished; and the shoots of those which took, were much shorter than those

those of what had been transplanted in the autumn. To replenish the empty spaces, he laid down some slips of the neighbouring plants, by which means he hoped those chasms would be filled up the next year.

This is a very simple and easy way to renew old pastures of lucerne, and to have constant crops of this excellent fodder. Great care is requisite, both in taking up the roots, and in planting them again.

CHAP. X.

OF CLOVER.

M. Duhamel says but little of this plant, whose great use will, we hope, apologize for our borrowing from other authors, and particularly Mr. Miller, such directions as may be sufficient to guide our husbandmen in the culture of it.

There are many sorts of clover: but the two principal ones are, the red and the white.

Clay lands, in particular, have been so much improved by sowing them with red clover, that they have produced six times the quantity of fodder that they used to do before the culture of this plant was so common in England as it now is.

The red clover is a biennial plant, whose roots decay after they have produced seeds: but if the plants are eat down, or mowed when they begin to flower, they will sprout out anew, and by that means continue longer than they otherwise would. The usual allowance of seed for an acre of ground, in the common husbandry, is ten pounds. In the choice of the seed, that which is of a bright yellow colour, inclining to brown, should be preferred; and the pale coloured thin seed should be rejected.

The general custom in this country is, to sow the clover seed with barley, in the spring: and when the barley is taken off the ground, the clover spreads and covers it, and remains two years: after which the land is plowed again for corn, and is thought to be greatly enriched by the clover. The clover seed should not be sown, till after the barley has been harrowed in; for otherwise it will be buried too deep: and after it is sown, the ground should be rolled, to press the seeds into it: but this should be done in dry weather; because moisture will often make the seeds burst, and when the ground is wet, they will stick to the roller, and the surface of the soil will be

so hardened by the rolling, that numbers of plants will fail, for want of being able to pierce it. This is the general method, when clover is sown with corn: but it would be much better always to sow it alone; for then the plants come on much faster, and are not choaked for one whole season, as they frequently are in the other way, when the crop of corn is great.

Mr. Miller, after many years trial, advises therefore to sow the seeds of clover in August, when there is a prospect of rain soon after: because the ground being then warm, the first shower of rain will bring up the plants, and they will have time enough to get strength before the winter; and a good rolling in October, when the ground is dry, will press it close to the roots, and make the plants send out more shoots: and this he advises repeating again in March. The reason of his preferring this season for sowing of clover, rather than the spring, is, because the ground is cold and wet in spring; and if much rain falls after the seeds are sown, they will rot in the ground; and many times, when the seed is sown late in the spring, if the season should prove dry, the seeds will not grow.

About the middle of May, this grass will be fit to cut; when particular care should be taken in making it into hay: for it will require a great deal more labour and time to dry, than common grass; and will shrink into less compass: but if it be not too rank, it will make excellent food for cattle. The time for cutting it is when it begins to flower; for if it stands much longer, the lower part of the stems, and the under leaves will turn yellow, and these last will fall off, and consequently the quantity of the hay will then be less, and not so well flavoured. Care should likewise be taken not to stack it till it be thoroughly dry, for fear of its heating.

One acre of this plant will feed as many cattle as four or five acres of common grass: but they must not be suffered to eat too plentifully of it at first, lest it burst them. It should be given them by degrees, till they are fully seasoned to it: nor should they ever be turned into this food in wet weather. Some sow rye grass amongst their clover, and let them grow together, in order to prevent the ill consequence of the cattle feeding wholly on clover: but in this they are to blame; because the rye-grass does great injury to the clover: for the rye-grass, being more early in the spring, covers and cripples the young clover, and besides is observed to exhaust the land, or rather binds the surface of it by its numerous creeping hori-

horizontal roots. Yet it is a question with farmers, whether the additional weight of grass which the rye-grass yields, does not counterbalance these disadvantages.

This plant is reckoned much better fodder for most other cattle, than for milch cows; wherefore these should seldom have any of it: tho' when it is dry, it is not near so hurtful to any sort of beasts, as when green.

When the seeds of clover are designed to be saved, the first crop in the spring should be let stand till they are ripe, which is known by the stalks and heads changing to a brown colour: and then the clover should be cut in fair weather, and be well dried before it is laid up; for otherwise the seeds will not easily quit the husks, when it is threshed. To this is owing a common complaint of farmers, that they oftentimes cannot thresh out their clover-seed without great labour and difficulty. It will generally be found in this case; that these are second crops, which ripen late in autumn, when there is not heat enough to dry the husks sufficiently to make them part easily from the seed.

The white clover, generally known amongst farmers by the name of white honeysuckle, is a lasting plant, whose branches trail upon the ground, and send out roots from every joint, so that it thickens and makes the closest sward of any of the artificial grasses. It is an exceeding sweet food for all sorts of cattle: for which reason, when land is design'd to be laid down for pasture, and to continue so, a quantity of the seeds of this plant should always be sown with the grass seeds. The usual allowance of this seed, is eight pounds to an acre: but it should never be sown with corn; because the corn will weaken it so that it will scarce be worth standing. And yet, as Mr. Miller observes, such is the covetousness of most farmers, that they will not be prevailed on to alter their old custom of laying down their grounds with a crop of corn; though they lose twice the value of their corn, by the poorness of the grass, which never will come to a good sward: and one whole season is also lost; for if this seed is sown in the spring without corn, there will be a crop of hay to mow by the middle, or latter end of July, and a much better after-feed for cattle the following autumn and winter, than the grass which is sown with corn will produce the second year.

The author of the *new system of agriculture* agrees with Mr. Miller, that clover should be sown in autumn, and always by itself, on land brought to the finest tilth possible, and clear'd of all fibrous roots,

roots, and other trash, by going over it with fine tooth'd harrows; but he differs from him in regard to the quantity of seed, the former strongly recommending never to sow less than twenty pounds upon an acre.

He observes that "many will object against this, as a double charge, because, say they, I never knew any man who sowed above half that quantity.—I answer," continues he, "they never knew any man who reap'd half the profit which he might have done by it, if they had followed my directions. It is observable, that there are more ignorant men, who profess husbandry, than of any other art; and yet fewer of this profession, than any of the rest, who think they can be taught. A man, not possessed of this temper, would easily imagine that the thicker this little seed is sown, the thicker it will spring, and the better keep down all weeds, and common grass, and, consequently, become of double advantage."

"Sowing clover in September, instead of the spring, and sowing it alone, has many conveniencies: it will rise thick, and swarth the ground, before the hard weather comes in; and thereby not only gather strength, to defend itself against the winter frosts; but will be so early in the spring, that you might mow it, the first time, in the very beginning of May, or, perhaps, sooner."

"When the first hard frost has bound the earth so fast that you may bring horses upon it, without damage to the roots of the clover, this is the very point of time in which you should bestow about eight or ten load of sea-ouze, sea-sand, sheep's dung, or that of our stercoreary, upon every acre, taking care to spread it as equally as may be, that, when the frost dissolves, the rains may drive the strength of the manure into the earth, which, in the tender infancy of the new turf, will easily admit it, to the nourishment of the roots, and surprising increase of your clover, both as to quantity and sweetness."

M. Duhamel mentions the following experiment, made by M. de Pontbriant of Rennes in Britany. He sowed 296 square toises, with flax and hemp, mixed with clover seed. As soon as the former were plucked up, the clover appeared, and grew so well that it was cut in November of the same year. It was weeded in February, and mowed again in the beginning of May. As it was too thick, he made alleys in it a foot wide. These alleys furnished him with plants enough to garnish 888 square toises of land. He looks upon the

the first spot as a nursery, from which he takes whatever plants he wants, and sets them in other ground a foot and a half asunder, which is a sufficient distance for hoeing. His field promises greatly.

CHAP. XI.

Of Pasture Ground, and Meadow.

PASTURE ground is of two sorts: viz. low meadow land, which is often overflowed; and up-land, which lies high and dry. We shall begin with this last.

The first thing requisite in this pasture, is, to fence it in, and divide it into fields of from four or five to ten acres each; planting timber trees in the hedge rows, to screen the grass from the sharp drying winds of March, which are so prejudicial to its growth in large open fields, that if April proves likewise a cold dry month, the land produces very little hay: whereas in shelter'd fields, the grass will begin to grow early in March, and will cover the ground so as to prevent the sun from parching the roots of the plants, which will be kept growing, and afford an early crop, if the spring is dry.

A general caution to be observed in fencing of land, especially where the hedge rows are planted with trees, is not to make the inclosures too small: because when the trees are grown high, they will shade the ground too much; and where they are too close, the grass will be rank and sour.

The turf should be made good, by sowing new seed, wherever the grass has been destroyed, whether by the badness of the soil, or for want of proper care, or by weeds, rushes, bushes, mole-hills, &c. If the land is cold and clayey, it may be improved by paring off the surface and burning it, as before directed: but if it is a hot sandy soil, chalk, lime, marle, or clay, are proper manures to lay upon it, and that in pretty large quantities; for otherwise they will do little good. If the ground is over-run with bushes, rushes, &c. they should be grubbed up towards the end of the summer, and burnt, and their ashes spread over the ground just before the autumnal rains; at which time the surface of the land should be levelled, and sown with grass-seed, which will come up in a short time, and make good grass the following spring. All mole-hills should likewise be pared off, and burnt for their ashes, or be spread thin upon the ground, after digging out their middle or core; and

and the holes should be left open all the winter, to destroy the ants.

It is of great service to roll the turf in February and March, with a heavy wooden roller; always observing to do it in moist weather, that the roller may the better level the surface. This renders the mowing of the grass much easier than when the ground lies uneven, and also makes the turf thicker, and the grass grow the sweeter. Mr. Miller thinks it likewise a great help to destroy weeds.

Feeding of up-land pastures, every other year, is another improvement of them: for where this is not practised, the land must be manured at least every third year. The time to spread the manure, is in autumn, before the rains have soaked the ground, and rendered it too soft to cart on: Though by the means of broad wheels, which do not cut the sward, this precaution is almost rendered useless; because they may with safety go on the grass at any time in the winter, or even in the spring. If the manure is laid on at this season, and carefully spread, and all the clods well broken, the winter rains will wash the salts down to the roots of the grass, which will receive the advantage of it the following spring.

Particular care should be taken to destroy all weeds in the pasture, every spring and autumn: for otherwise, they will ripen their seeds, which will spread over the ground, and kill the grass: nor can they afterwards be rooted out, without great difficulty.

The grass of up-land pastures seldom degenerates, if the land is tolerably good: but that of low meadows, which are overflowed in winter, grows harsh and rushy in a few years.

"There is no part of husbandry," says Mr. Miller, "of which the farmers are, in general, more ignorant than that of the pasture. Most of them suppose, that when an old pasture is plowed up, it can never be brought to have a good sward again: so their common method of managing their land after plowing, and getting two or three crops of corn, is to sow with their crop of barley, some grass seeds (as they call them); that is, either the red clover, which they intend to stand two years after the corn is taken off the ground, or rye-grass mixed with trefoil: but as all these are at most but biennial plants, whose roots decay soon after their seeds are perfected, so the ground, having no crop upon it, is again plowed for corn: and this is the constant round which the lands are employed in, by the better sort of farmers; for I

"have

" have never met with one of them, who had the least notion of
" laying down their land to grass for any longer continuance; there-
" fore the seeds which they usually sow, are the best adapted for
" this purpose.

" But whatever may have been the practice of these people, I
" hope to prove, that it is possible to lay down land which has
" been in tillage, with grass, in such a manner that the sward shall
" be as good, if not better, than any natural grass, and of as long
" duration. But this is never to be expected in the common me-
" thod of sowing a crop of corn with the grass seed; for wherever
" this has been practised, if the corn has succeeded well, the grass
" has been very poor and weak; so that if the land has not been
" very good, the grass has scarcely been worth standing: for the
" following year it has produced but little hay; and the year after,
" the crop is worth little, either to mow or feed: nor can it be
" expected it should be otherwise; for the ground cannot nourish
" two crops."

In consequence of this, Mr. Miller proceeds to give the follow-
ing directions for the management of pasture ground.

When ground is laid down for grass, no crop of any kind should
be sown with the seeds, and the land should be well plowed, and
cleaned from weeds. The best season to sow the grass-seeds, upon
dry land, is about the middle of September, or sooner, if there is
an appearance of rain; because, the ground being then warm, if
some good showers of rain fall after the seed is sown, the grass will
soon make its appearance, and get sufficient rooting in the ground
before winter, not to be in danger of being turned out by the frost;
especially if the ground is well rolled before the frosts come on.
If the grass comes up well, this rolling should be performed to-
wards the end of October or the beginning of November, and repeat-
ed again in the beginning of March. The sward will, in this case,
be closely joined at the bottom, and a good crop of hay may be ex-
pected the same summer. In cold lands, which lie very open and
exposed, it will be right to sow the seeds a month earlier, that the
grass may have time to get good rooting, before the cold season
comes on to stop its growth. If the ground cannot be prepared for
sowing in autumn, it may be sowed in the middle or latter end of
March, according as the season is early or late. The danger of
sowing late, is, dry weather, especially if the soil is light and dry.
It will then be proper to roll the ground well, soon after the seeds

are sown, to settle the surface, and prevent its being blown away, together with the seeds, as has frequently happened, by the high winds in March.

The best seed for this purpose, is the best sort of upland hay-seed, taken from the cleanest pastures, where there are no weeds. Three, or at most four bushels of this seed, well sifted and cleansed, are sufficient to sow an acre of land. The next best is, white clover-seed, of which eight pounds are sufficient for an acre. The grass-seed should be sown first, and the white, or, as it is commonly called, Dutch clover-seed afterwards: but they should not be sown mixed together, because the clover-seeds, being heaviest, will fall to the bottom, and the ground will consequently be unequally sown.

After the seeds are sown, the ground should be harrowed lightly to bury them: but this should be done with a short tooth'd harrow; for otherwise the seeds will be buried too deep. If the surface of the ground is dry, it should be rolled, two or three days after sowing, with a barley roller, to break the clods, and settle the ground; which will prevent the seeds from being removed by the wind.

When the seeds are come up, the ground should be weeded: otherwise the weeds will increase, so as to keep down the grass, and starve it: and if they are suffered to remain till they have shed their seeds, they will over-run the land, and entirely destroy the grass. One of the principal parts of husbandry, is never to suffer weeds to grow.

If the ground is rolled two or three times, at proper intervals, after the grass is up, it will make it form a thicker bottom: for as the white clover puts out roots from every joint of the stalks which are near the ground, the roots will mat so closely together, as to cover the whole surface of the ground with a sward capable of resisting any common drought.

Where pastures are laid down to remain, the white clover is certainly the best sort to sow, because it is a lasting plant, and does equally well on wet or dry land. The hay seeds, though taken from the very best pastures, will be composed of various sorts of grass, some annual, and others biennial; so that when they go off, many large patches of ground will remain bare and naked, if there is not a sufficient quantity of that clover, to cover the land. Every summer affords us proofs of this, in all our common pastures, in which we frequently see no other verdure left, but this clover, which grows

grows naturally upon gravel and clay, in most parts of England: a plain indication how easily this plant may be cultivated to great advantage, in most sorts of land throughout this kingdom.

It is therefore plainly owing to our farmers not distinguishing grasses that are annual from those which are perennial, that land which has been in tillage is not brought to a good turf again, in the common method of husbandry: for annual and biennial grasses will soon decay, and nothing can be expected to succeed them, but what will grow naturally, except, perhaps, on some spots, where their seeds may chance to have ripened and sown themselves. This, added to the covetous method of laying down the ground with a crop of corn, has been the true cause of the decrease of pasture in many parts of England, where it is now much more valuable than arable land.

After the ground has been brought to a good sward, the way to preserve it so, is to roll it constantly every spring and autumn, with a heavy roller, and to keep it clear from all sorts of weeds. Dressing of these pastures every third year, is also necessary; for otherwise, it cannot be expected that this ground, which has not the benefit of tillage, should continue to produce good crops: and another thing proper to be observed, is to change the seasons of mowing, and not to mow the same ground every year; but to mow one season, and feed the next: for the ground that is mowed every year, will soon be exhausted, if it has not a constant supply of manure.

A great advantage of dry upland pastures, is, that they may be fed all the winter, which low wet meadows cannot be.

Meadow land will indeed produce a much greater quantity of hay than upland pasture, and will not require manuring so often: but then the upland hay is infinitely better, and far sweeter food for cattle.

S E C T. II.

Of Meadow.

THERE are two kinds of meadows in England, the one called water-meadows, and the other only meadows.

Mr. Worlidge distinguishes three sorts of water meadows; viz.

1. Such as lie flat on the banks of great rivers, and are subject to be overflowed by them in times of land floods only.
2. Such as lie near smaller rivers or streams, and are capable of being drowned or

watered, by diverting such river, or some part thereof, out of its natural current, over them. 3. Such as lie above the level of the water, and are flowed by raising the water by art.

On the borders of our great rivers and currents, are the richest meadows, consisting generally of a very good fat soil, composed, as it were, of the sediment of the water overflowing them after great and heavy rains. These are capable of but little farther improvement. But when their soil is naturally dry and hungry, and they are not frequently overflowed by land-floods, artificial works may be made use of, to raise the water over them, to very considerable advantage.

The art of diverting smaller rivers and streams, over the meadows near them, is universally known and practised, and to great advantage.

Where the water is situated above the level of the ground intended to be flowed, it may easily be let in, at proper seasons, by drains, like those hereafter directed for draining of land. Care should be taken to have good sluices at the heads of the drains, that the water may not come in, but when it is wanted; for otherwise the meadow, instead of being improved, would be greatly damaged by it.

Where the land lies above the level of any water near it, the overflowing of it will be more expensive; because the water must, in that case, be raised by machines. The most common engine used for this purpose, is the Persian wheel, of which Mr. Worlidge gives the following description.

“ This wheel is made much after the manner of that of an under-shot mill, viz. with a double ring, into which are let two pins, on which the floats are fastened. These floats are made hollow: the half that is most remote from the wheel, holds the water which is taken in at the open place, above the middle of the back of the float, and as the wheel goes round, and the float laden with water rises, so the water, by degrees, tends towards that part of the float which is next the wheel; and as the float surmounts the cistern or receiver, the water empties itself into it; every float, succeeding th’one the other, emptying itself into the receiver: so that if one float contain a gallon of water, and there be 30 floats on the wheel, at one motion round it delivers 30 gallons of water into the cistern. Such a wheel will be about 15 foot diameter, the floats at 18 inches distance, and will deliver the water at 11 or

12 foot

“ 12 foot above the level of your stream, and will go four times
 “ round in one minute, and carry up about 120 hogheads of wa-
 “ ter in an hour, with 12 or 18 inches penning or stopping of but
 “ an ordinary current of water, which will water very well 30 or
 “ 40 acres of land: for if your land be cold and clayey, too much
 “ water does it hurt; and if it be light, warm, or sandy, a little
 “ water does it much good. It is also to be observed, that this mo-
 “ tion is constant, and will last many years without repair, so that
 “ it stand not still, the one side drying and waxing lighter than the
 “ other: also observe, that the slower it moves, the better it deli-
 “ vers the water.

“ The view of this wheel we have in Pl. I. Fig. 2. *aaaa* signify
 “ the wheel; *b*, the cistern that receives the water; *cc*, the trough
 “ standing on tressels, that conveys the water from the cistern to the
 “ place you desire; *d*, the hatch, or pen-stock that bays up the wa-
 “ ter to a reasonable height, under which the water drives the
 “ wheel; *e*, one of the floats presented to your eye, apart from the
 “ wheel; *f*, the open place that is to receive the water; *g*, the
 “ open place out of which the water issues; *bb*, the two pins or
 “ ledges riveted on to the fore-side of the float, and wherewith you
 “ are to fix the float to the two rings of the wheel. These, or
 “ such like wheels are much used in Spain, Italy, and France, and
 “ are esteemed the most easy and advantageous way of raising water
 “ in great quantity, to any height within the diameter of the wheel,
 “ where there is any current of water, to continue it in motion,
 “ which a small stream will do.

“ How many acres of land lie on the declining sides of hills, by
 “ the sides of rivers, in many places where the water cannot be
 “ brought unto it by any ordinary way? yet by this wheel placed in
 “ the river, may the land be continually watered so far as is under
 “ the level of the water when raised.”

Mr. Worlidge proceeds to observe, that there are many large and
 flat pieces of land, bordering upon rivers, in which the Persian wheel
 cannot be placed without trespassing upon the opposite neighbour,
 &c. but where wind-mills may be erected on the highest part of
 the land you intend to overflow. Though this place may be at
 some distance from the river, the water may be easily conducted
 thereto by an open or subterraneous passage from the river.

Such mills are experienced to be of great service in draining of
 fens and marshes, and may likewise be used to great advantage in
 raising

raising salt water to overflow meadows lying near it; but above the level of high water. These salt marshes, as they are called, have been found an excellent remedy for many diseases of horses and other cattle.

When the water is brought to the desired height, the main channel should be cut, giving it a convenient descent so as just to keep the water in motion. The mouth of the channel should be of breadth, rather than depth, sufficient to receive the whole stream; and as the water is carried off in lesser channels, the main channel should be made narrower by degrees, so that the water may press into the lesser channels which issue all along from the main one. The lesser channels should be as shallow, and as many in number as can be: for though cutting so much turf may seem to waste a great deal of land, yet it proves not so in the end; for the quicker the water runs over the grass, the greater the improvement is. Care should be taken to cut the drains in such a manner, that no water may remain to stagnate upon the land.

The farmer must be cautious not to bring any water of mineral springs upon his pasture; such being either destructive of grass, or producing a very harsh coarse kind of it.

Cold, clayey, strong lands, which lie flat, are not improved by watering; for the water cannot penetrate such. Light, warm, dry, sandy soils, are those which are most benefited by watering.

A very wrong custom prevails amongst our farmers in general, with respect to these low grounds; which is, that of flowing them all the winter. The roots of all the sweetest kinds of grass are thereby destroyed, and only such left as are natives of marshes, which are coarse and sour, and which no cattle will eat.

The method which Mr. Miller proposes for the management of these meadows, is, never to flow them till the middle or latter end of March, excepting once or twice in winter, when there may happen floods, which may bring down a great deal of soil from the upper lands, at which time it will be of great service to let water upon the meadows, that the soil may settle there: but the sooner the wet is drained off after this is lodged, the greater advantage the meadows will receive by it. By letting on the water frequently, from the end of March to the middle of May, the growth of the grass will be greatly assisted, and there will be no danger then of destroying its roots. It will also be of great service to these meadows to flow them again, if the season should prove dry, after the hay is carried off the ground:

ground : but when this is done, no cattle should be turned into the meadows, till the surface is become firm enough to support their weight without poaching the land ; for otherwise the grafs will suffer more by the treading of the cattle, than it will receive benefit by the flowing.

Weeding of these meadows twice a year, viz. in April and October, by cutting up the roots of docks and all other weeds, will be another great improvement of them : and so will, rolling them with a heavy roller, in spring and autumn. This last operation will level the surface of the ground, whereby it may be mown much closer, and will also sweeten the grafs.

The same care should be taken to weed and roll meadows which cannot be flowed, and likewise not to suffer heavy cattle to graze upon them in winter when they are wet. They should therefore be fed down in the autumn, before the heavy rains come on : and those pastures which are drier, may be kept to supply the want of these in winter. If there should not be cattle enough to eat down the grafs in time, it will be much better to cut off what is left, than to suffer it to rot upon the ground ; for that will hinder the grafs from shooting early in the spring.

Those who are best skilled in this part of husbandry, dress their meadows every other, or at least every third year, without which no good crop of hay can be expected : but the generality of farmers, following the old method, are so much distressed for dressing to supply their corn land, that they have not any to spare for their meadows. What dung they do use, is generally laid on in the beginning of winter, and spread as soon after as can conveniently be done : in which situation it remains all the winter. When the frosts are over, the dung is raked anew, and the clods in it are broken. The gross and useless parts, which would only obstruct the growth of the grafs, are then carried off* : and if the dung is not sufficiently rotted, they amount, sometimes, to almost as many load as were first laid on.

The advantage which plants receive from dung spread upon the surface

* This operation is indispensably necessary, when dung is used which is not thoroughly rotten : because the straw of such dung, mixing with the grafs, gives cattle, and particularly horses, a great dislike to it. For this reason, careful farmers always let the dung be well rotted, and reduced to a perfect mould before they lay it on their meadows, or, for want of such dung, they use ashes, pigeons dung, soot, lime, chalk, marle, &c.

surface of the ground, arises from the rich particles of the dung being as it were filtrated through that surface, and carried down into the earth, by rain or the melting of the snow: but many of those particles are undoubtedly lost, and never reach the roots of the plants.

M. de Chateau-vieux, sensible of this inconvenience, particularly with respect to grass grounds, rightly concluded, that the dung would have a much greater effect, if only just the surface of the meadow could be cut, and some of the internal parts of the earth laid open, so that the enriching particles of the dung may more immediately reach the roots of the grass.

He has succeeded admirably in this important improvement, by means of his three-coulter'd plough. In November, or December, the whole surface must be cut with that plough into slips of three inches breadth, which is the distance between each of the coulter's. This will have two effects: first, the coulter's will tear up great part of the moss with which all old pastures are infected, and gradually destroy it. Secondly, the coulter's, piercing into the earth five or six inches deep, cut the extremities of many of the roots of the grass, and those cut or broken roots afterwards produce new ones, which give fresh strength and vigor to the plants, and, as it were, renew and make them young again.

This division of the surface of the ground, will be very beneficial to the meadows. If the following year proves wet, it will greatly favour the production of new roots.

To render this improvement still more perfect, as soon as the whole surface of the meadow is cut, dung must be carried on it, and spread as quickly after as possible. The smaller the dung is broken, the more useful it will be: because the small particles will be carried by the rain into the traces which the plough has cut, and give surprising strength to the plants.

This method of repairing and improving poor or worn out meadows and pasture grounds, does not require any great quantity of dung: one load of it will go as far, in this practice, as three would in the common way; and be much more beneficial to the grass. M. de Chateau-vieux has tried it for some years, with all the success he could desire. His grass, thus improved, has always been very thick and long, and has yielded him plentiful crops of hay, when fodder has been extremely scarce every where else. In his opinion

opinion, one acre thus cultivated, will produce as much grass as ten in the common way.

Another use which he makes of the three coulter'd plough is, to break up grass lands intended to be converted into arable. The coulters enter five or six inches deep into the ground, and cut the turf into parallel slips of about three inches breadth. Two horses will draw this plough with ease, even though it should have five coulters instead of three, as it may, for the sake of greater expedition.

When the whole surface is thus cut in slips, all in the same direction, M. de Chateau-vieux plows the field cross-ways with a common plough, taking only about the breadth of six inches at each turn of the plough; by which means those slips of grass are broken into pieces, the largest of which are not above six inches long and three inches wide.

These plowings should be performed before winter and in the spring. The lumps of turf, exposed on all sides to the penetrating frosts of winter, are either quite moulder'd down, or rendered so friable thereby, that the field may be plowed afterwards with as much ease as if it had been tilled for several years.

M. de Chateau-vieux's description of this plough, is as follows.

The three coulter'd plough, *Plate I. Fig. 3.* consists of a beam *A, B*, two handles *C, D*, supported by the piece *E*. The two pieces of wood *F, F*, are fastened firmly to the beam by two strong iron pins *G, G*, on the other end of which a nut is screwed as tight as possible. These two side pieces, as well as the beam, are pierced with as many mortises *H, H, H*, as it is intended to use coulters. The coulters should fit the mortises as exactly as can be: and they should be placed at such distance from each other, that their points may form parallel lines three inches asunder, in order to cut the turf into slips of that breadth, as at *I, I, I*.

1, 2, 3, are three coulters exactly alike, of which the blade *M, I*, should be made of tough well hammer'd steel. Only three coulters are represented in this figure, in order to render it less confused: but if it is thought proper to use five coulters, by which means the work will be greatly expedited, two additional ones may easily be added, by making the pieces *F, F*, larger in proportion.

The beam is pierced with the two mortises *K, K*, in order to

C c c

fasten

fasten it to the fore carriage of a common plough, by running the cross staves of that carriage, through those mortises.

The coulter is provided with several holes, viz. at L and M. In order to raise them higher, or let them lower down, and they should be of equal lengths below the beam, that all of them may enter equally deep into the ground. Besides the pin which fastens them at top, a wooden pin should be stuck into the hole immediately below the beam, to prevent their being raised up by their pressure upon the earth.

The draining of land is another great improvement to it; for the meadows and pastures which are capable of being overflowed, produce a greater quantity of herbage than dry land; yet where the wet lies too long upon the ground, the grass will be sour and extremely coarse, and if great care is not taken to drain this land, it will produce little grass, but will soon be over-run with rushes and flags, so as to be of little value. The land which is most liable to this, is cold stiff clay, where the water cannot penetrate, but is contained as in a dish, so that the wet which it receives in winter, continues till the heat of the sun exhales it.

The best method for draining of these lands, is to cut several drains a-cross the ground, in those places where the water is subject to lodge, and other larger drains to carry it off from them, to either ponds or rivers in the lower parts of the land. These drains need not be made very large, unless the ground be very low, and so situated as not to be near any river to which the water can be conveyed; in which case there should be large ditches dug at proper distances, in the lowest part of the ground, to contain the water, and the earth which comes out of those ditches, should be equally spread on the land.

* Having never seen one of these ploughs, it is with great deference that we would presume to find the least fault in what is proposed by so accurate a gentleman as M. de Chateau-vieux. As this plough appears at present, too much seems to depend on the skill and dexterity of the plowman, to keep the coulter at a proper depth; there being no support at the heel of the plough, to render it more steady, so takes off the weight, and thereby lessen the labour of the plowman. We would therefore propose, that an axle-tree should pass through the beam, near the insertion of the handles, on which two wheels, proportioned to the length of the coulter, may turn at the distance of nine inches. This distance will be sufficient to render the plough more steady, and these wheels will greatly lessen the plowman's labour; and, running an inch and an half beyond the traces of the two outward coulter, if there are but three, and an inch and an half within the two outmost, in case there are five, they will not interfere with the operation of this operation.

Fig. 1.

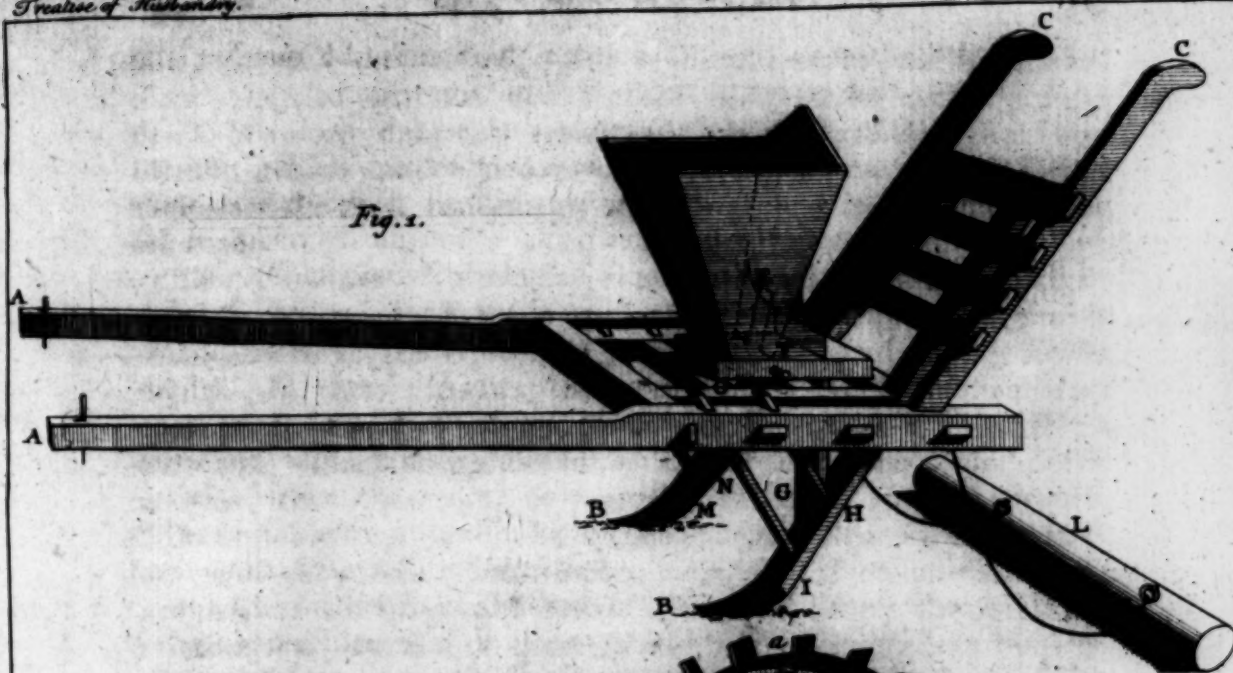


Fig. 2.

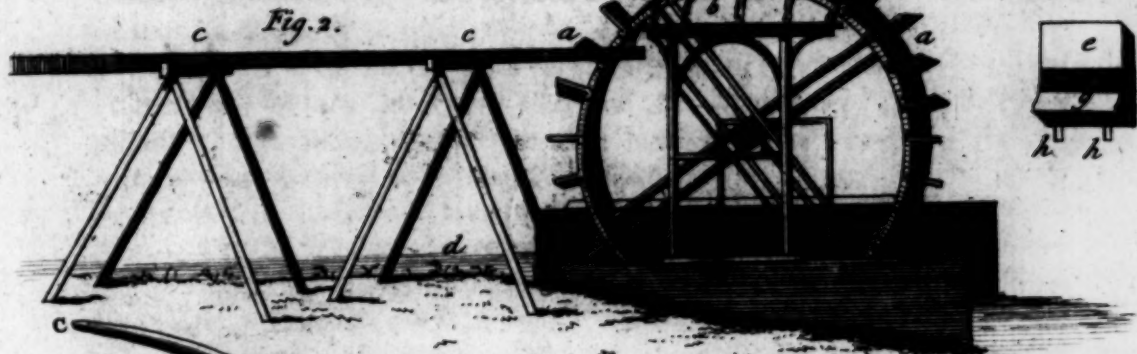
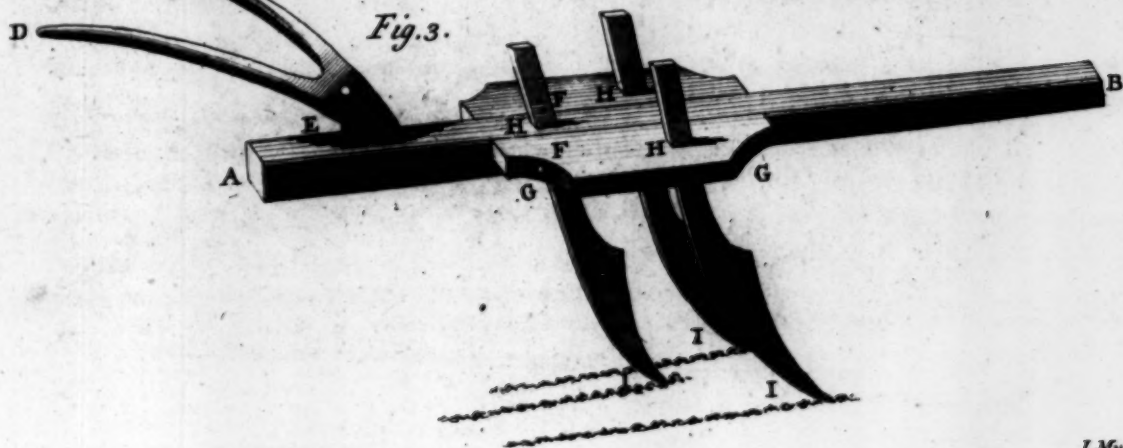


Fig. 3.





land, to raise the surface. But where the water can be conveniently carried off, the best method is, to make under ground drains at proper distances, which may empty themselves into large ditches, which are designed to carry off the water. These sort of drains are the most convenient, and no ground is lost where they are made.

The usual method of making them, is to dig trenches to a proper depth for carrying off the water, which, for the principal drains, should be three feet wide at top, and sloped down to a sufficient depth. In these trenches, drains may be built in the manner of common sewers, and covered over with the earth dug out of the trenches. These drains should be at least a foot deep, and nearly as wide, that there may be room for the water to pass through. The larger drains should be at convenient distances, and smaller drains of about six or seven inches wide, should be cut a-cross the ground, to discharge the water into these larger drains. The number and situation of them should be proportioned to the wetness of the land, and the depth of the earth above the drains should exceed a foot.

The best time of the year for making these drains is about Michaelmas, before the heavy rains of the winter begin to fall, because at this season of the year the land is usually dry, so that the drains may be dug to a proper depth.

You should always make choice of such plants as are strong and well ripened, of the last year's growth. These should be cut from the old vine, just below the place where they were produced, taking a knot or piece of the wood to each, which should be pinned smooth: the cuttings should be about two inches long, and the ends should be cut at an oblique angle, so that they may be easily inserted into the ground. The covering should not remain on, because the cuttings grow, when they are to be planted, they should be taken out of the ground, and their upper part cut off, so as to reduce them to about fourteen inches in length, according to the distance of the buds or eyes: for those cuttings which grow pretty close together, need not be less than one foot long: but on others, fourteen or fifteen inches will be full.

land, to raise the surface. But where the water can be conveyed, it is better to make a ditch, and to carry off the water, than to make under ground drains, which are designed to carry off the water. These sorts of drains are the most convenient, and are made in the following manner.

WE shall here borrow Mr. Miller's judicious directions for the first planting of the vine, and then give the observations and experiments of Messrs. de Chateau-vieux and Roussel, on the farther culture and management of it.

All sorts of vines are propagated either from layers or cuttings, the former of which is greatly practised in England, but the latter, says Mr. Miller, "is what I would recommend, as being much preferable to the other; for the roots of vines do not grow strong and woody, as in most sorts of trees, but are long, slender, and pliable: therefore when they are taken out of the ground, they seldom strike out any fibres from the weak roots, which generally shrivel and dry, so that they rather retard than help the plants in their growth, by preventing the new fibres from pushing out: for which reason I had rather plant a good cutting than a rooted plant, provided it be well chosen: and there is little danger of its not growing."

But as there are few persons who make choice of proper cuttings, or at least that form their cuttings rightly in England; so it will be proper to give directions for this in the first place, before I proceed.

"You should always make choice of such shoots as are strong and well ripened, of the last year's growth. These shoots should be cut from the old vine, just below the place where they were produced, taking a knot, or piece of the two years wood to each, which should be pruned smooth: these ends should then be laid into the ground, about two inches deep, and the rest of the cuttings be left at full length, only observing to cover them with dry litter or pease-haulm in frosty dry weather; though in moist weather, the covering should not remain on, because it would make the cuttings grow, which would greatly injure them. In the spring, when they are to be planted, they should be taken out of the ground, and their upper part cut off, so as to reduce them to about fourteen inches in length, according to the distance of the buds or eyes: for those cuttings where buds grow pretty close together, need not be left more than one foot long; but on others, fourteen or fifteen inches will be full short.

short. The leaving the upper part of the shoots on all the winter, is of great service to the cuttings: because when they are cut off in autumn, the air penetrates the wounded part, and greatly injures the other eyes. In making the cuttings after this manner, there can be but one taken from each shoot: whereas most persons cut them into lengths of about a foot, and plant them all, which is very wrong: for the upper part of the shoots are never so well ripened as the lower, which was produced early in the spring, and has had the whole summer to harden; so that if they take root, they never make so good plants; for the wood of those cuttings being spongy and soft, admits the moisture too freely, whereby the plants will be luxuriant in growth, but never so fruitful as those whose wood is closer and more compact.

"The cuttings may remain in the ground till the beginning of April, (which is the best time for planting them,) when you should take them out, and wash them from the filth they have contracted, and if you find them very dry, you should let them stand with their lower parts in the water, six or eight hours, which will distend their vessels, and dispose them for taking root. Then the ground being before prepared where the plants are designed to remain, whether against walls, or for standards, (for they should not be removed again,) the cuttings should be planted: but in preparing the ground, you should consider the nature of the soil, which, if strong, and inclinable to wet, is by no means proper for grapes; therefore where it so happens, you should open a trench where the cuttings are to be planted, which should be filled with lime rubbish, the better to drain off the moisture: then raise the border with fresh light earth about two feet thick, so that it may be at least a foot above the level of the ground: then you should open the holes at about six feet distance from each other, putting one good strong cutting into each hole, in which it should be laid a little sloping, and so deep, as that the uppermost eye may be level with the surface of the ground: for when any part of the cutting is left above ground, as is the common method used by the English gardeners, most of the buds attempt to shoot; so that the strength of the cutting is divided to nourish so many shoots, which must consequently be weaker than if only one of them grew: whereas on the contrary, by burying the whole cutting in the ground, the sap is all employed in one single shoot, which consequently will be much stronger: besides, the sun and air

are

are apt to dry that part of the cutting which remains above ground, which often prevents their buds from shooting. Having plac'd the cutting in the ground, you should fill up the hole, gently pressing down the earth with your foot close about it, and raise a little hill just upon the top of the cutting, to cover the upper eye quite over, which will prevent it from drying. This being done, there is nothing more necessary, but to keep the ground clear from weeds, until the cuttings begin to shoot; at which time you should look them over carefully, to rub off any small shoots, if such are produced, leaving only one main shoot to the wall, which should be constantly trained up, as it extends in length, to prevent its breaking, or hanging down. You must continue to look over these once in about three weeks during the summer season, constantly rubbing off all lateral shoots which are produced, leaving only the first main shoots: and be sure to keep the ground constantly clear from weeds, which, if suffered to grow, will exhaust the goodness of the soil, and starve the cuttings.

The Michaelmas following, if your cuttings have produced strong shoots, you should prune them down to two eyes, which, though by some people may be thought too short, yet I am satisfied, from several experiments, to be the best method. The reason for advising the pruning of vines at this season, rather than deferring it till spring, is, because the tender parts of those young shoots, if left on, are subject to decay in winter; for they are apt to grow late in the year; so the tops of their shoots are tender, and the early frosts will pinch them, and then they are frequently killed down a considerable length, which weakens their roots: but if they are cut off early in autumn, the wound will heal over before the bad weather, and thereby the roots will be greatly strengthened.

In the spring, after the cold weather is past, you must gently dig up the borders, to loosen the earth: but you must be very careful in doing this, not to injure the roots of your vines. You should also raise the earth up to the stems of the plants, so as to cover the old wood, but not so deep as to cover either of the eyes of the last year's wood. After this, they will require no farther care until they begin to shoot, when you should look over them carefully, to rub off all weak dangling shoots, leaving no more than the two shoots, which are produced from the two eyes of the last year's wood, which should be fastened to the wall; and so from this, until the vines have done shooting, you should look them over once in three weeks

or

or a month, to rub off all lateral shoots as they are produced: and to fasten the main shoots to the wall, as they are extended in length, which must not be shortened before the middle, or latter end of July, when it will be proper to nip off their tops, which will strengthen the lower eyes: and during the summer season, you must constantly keep the ground clear from weeds: nor should you permit any sorts of plants to grow near the vines; which would not only rob them of nourishment, but shade the lower parts of the shoots, and thereby prevent their ripening; which will not only cause their wood to be spongy and luxuriant, but render it less fruitful.

As soon as the leaves begin to drop in autumn, you should prune these young vines again, leaving three buds to each of the shoots, provided they are strong; otherwise it is better to shorten them down to two eyes, if they are good; for it is a very wrong practice to leave much wood upon young vines, or to leave their shoots too long, which greatly weakens the roots: then you should fasten them to the wall, spreading them out horizontally each way, that there may be room to train the new shoots the following summer; and in the spring, dig the borders as before.

The third season, you must go over the vines again, as soon as they begin to shoot, to rub off all danglers as before; and train the young shoots in their proper places, which this year may be supposed to be two from each shoot of the last year's wood: but if they attempt to produce two shoots from one eye, the weakest of them must be rubbed off; for there should never be more than one allowed to come out of each eye. If any of them produce fruit, as many times they will the third year, you should not stop them so soon as is generally practised upon the bearing shoots of old vines, but permit them to shoot forward till a Month after Midsummer, at which time you may pinch off the top of the shoots: for if this were done too soon, it would spoil the buds for the next year's wood, which in young vines must be more carefully preserved than on older plants, because there are no other shoots to be laid in for a supply of wood, as is commonly practised on old vines.

During the summer, you must constantly go over your vines, and displace all weak lateral shoots as they are produced, and carefully keep the ground clear from weeds, as was before directed, that the shoots may ripen well; which is a material thing to be observed in most sorts of fruit trees, but especially in vines, which seldom produce

duce any fruit from immature branches. These things, being duly observed, are all that is necessary in the management of young vines. I shall therefore proceed to lay down rules for the government of grown vines, which I shall do as briefly as possible.

"Vines seldom produce any bearing shoots from wood that is more than one year old: therefore great care should be taken to have such wood in every part of the trees: for the fruit is always produced upon shoots of the same year, which come out from buds of the last year's wood. The method commonly practised by the gardeners in England is, to shorten the branches of the former year's growth, down to three or four eyes, at the time of pruning; though there are some persons who leave these shoots much longer, and affirm that by this practice they obtain a greater quantity of fruit: but however this may be, it is a very wrong practice, since it is impossible that one shoot can nourish forty or fifty bunches of grapes, so well as it can ten or twelve; so that what is gotten in numbers, is lost in their magnitude. Besides, the greater quantity of fruit there is left on vines, the later it is ripened, and the juice is not so rich. This is so well known in the wine countries, that there are laws enacted to direct the number and length of shoots that are to be left upon each vine; lest by over-bearing them, they not only exhaust and weaken the roots, but thereby render the juice weak, and so destroy the reputation of their wine.

"The best method therefore is, to shorten the bearing shoot, to about four eyes in length, because the lowermost seldom is good, and three buds are sufficient: for each of these will produce a shoot which generally has two or three bunches of grapes; so that from each of those shoots there may be expected six or eight bunches, which are a sufficient quantity. These shoots must be laid about eighteen inches asunder: for if they are closer, when the side shoots are produced, there will not be room enough to train them against the wall, which should always be provided for: and as their leaves are very large, the branches should be left at a proportionable distance from each other, that they may not crowd or shade the fruit.

"At the winter pruning of your vines, you should always observe to make the cut just above the eye, sloping it backward from it, that if it should bleed, the sap may not flow upon the bud: and where there is an opportunity of cutting down some young shoots to two eyes, in order to produce vigorous shoots for the next year's bear-

bearing, it should always be done; because the stopping of those shoots which have fruit upon them, as soon as the grapes are formed, which is frequently practised, often spoils the eyes for producing bearing branches the following year; and this reserving of new wood, is what the vine dressers abroad always practise in their vineyards. The best season for pruning of vines, is about the middle or end of October.

"The latter end of April or the beginning of May, when the vines begin to shoot, you must carefully look them over, rubbing off all small buds which may come from the old wood, which only produce weak dangling branches; as also when two shoots are produced from the same bud, the weakest of them should be displaced, which will cause the others to be stronger; and the sooner this is done, the better it is for the vines.

"In the middle of May, you must go over them again, rubbing off all the dangling shoots, as before; and at the same time you must fasten up all the strong branches, so that they may not hang from the wall: for if their shoots hang down, their leaves will be turned with their upper surfaces the wrong way, and when the shoots are afterwards trained upright, they will have their under surface upward, and until leaves are turned again, and have taken their right position, the fruit will not thrive; so that the not observing this management will cause the grapes to be a fortnight or three weeks later before they ripen: besides, by suffering the fruit to hang from the wall, and be shaded with the closeness of the branches, it is greatly retarded in its growth: therefore during the growing season, you should constantly look over the vines, displacing all dangling branches and wild wood, and fasten up the other shoots regularly to the wall, as they are extended in length; and towards the middle of June, you should stop the bearing branches, which will strengthen the fruit, provided you always leave three eyes above the bunches: for if you stop them too soon, it will injure the fruit, by taking away that part of the branch which is necessary to attract the nourishment to the fruit, as also to perspire off the crudities of the sap, which is not proper for the fruit to receive.

"But although I recommend the stopping those shoots which have fruit, at this season, yet this is not to be practised upon those which are intended for bearing the next year; for these must not be stopped before the middle of July, lest, by stopping them too soon, you

cause

cause the eyes to shoot out strong lateral branches, whereby they will be greatly injured.

"During the summer season, you should be very careful to rub off all dangling branches, and train up the shoots regularly to the wall, as before, which will greatly accelerate the growth of the fruit, and also admit the sun and air, which is absolutely necessary to ripen and give it a rich flavour: but you must never divest the branches of their leaves, as is the practice of some persons; for although the admitting of the sun is necessary to ripen the grapes, yet if they are too much exposed thereto, their skins will be tough, and they will rarely ripen: besides, the leaves being absolutely necessary to nourish the fruit, by taking them off, the fruit is starved, and seldom comes to any size: therefore a great regard should be had to the summer management of the vines, where persons are desirous to have their fruit excellent and duly ripened.

"When all the fruit is gathered, you should prune the vines, whereby the litter of their leaves will be entirely removed at once, and their fruit will be the forwarder the succeeding year.

For the farther culture of the vine, in gardens, and in the different countries of Europe, we refer the curious to the article *Vitis* in Mr. Miller's Gardener's Dictionary, and shall proceed to give that gentleman's directions for the management

SECTION II.

Of Vineyards in England.

"THERE have of late years been but very few vineyards in England, though they were formerly very common, as may be gathered from the several places in divers parts of England which yet retain that name, as also from ancient records, which testify the quantities of ground that were allotted for vineyards, to abbeys and monasteries, for wine for the use of the inhabitants; but as to the quality of the wines which were then produced in England, we are at present ignorant, and how these vineyards were rooted up, and became so generally neglected, we have no very good accounts left. Whatever might be the cause of this total neglect of cultivating vines in England, I will not pretend to determine, but such was the prejudice most people conceived to any attempts of producing wine in England, that, for some ages past, every trial of that kind has been ridiculed by the generality of people,

" people, and at this day very few persons will believe it possible to
 " be effected. Indeed if we judge only by the success of some modern essays
 " made near London, where small vineyards have been planted a
 " few years past, there would be no great encouragement to begin a
 " work of this kind, because the produce of very few of these vine-
 " yards has been so kindly as were to be wished: but however, this
 " should not deter others from making farther trials, especially when
 " they consider the many disadvantages, which most or all of those
 " plantations which have been made, were attended with; for first
 " there is scarce one of them placed upon a proper soil and situation
 " for this purpose; and secondly, there is not one which is rightly
 " planted and managed, as I shall presently shew: and how can we
 " expect success from vineyards under these disadvantages, when even
 " in France or Italy they would succeed little better, if their ma-
 " nagement were not directed with more judgment? I shall therefore
 " humbly offer my opinion, which is founded upon some trials
 " I have seen made, and from the instructions that I have received
 " from several curious persons abroad, who cultivate vineyards for
 " their own use, and that of their friends, and who have been very
 " exact in observing the several methods of practice amongst the *Vig-*
 " *nerons* of those countries; from whence it is hoped that the preju-
 " dice, which most people have against a project of this kind, will
 " either be removed, or at least suspended, until trials have been ju-
 " diciously made of this affair.

" The first and great thing to be considered in planting vineyards
 " is the choice of soils and situations, which, if not rightly chosen,
 " there will be little hopes of success; for upon this the whole affair
 " greatly depends. The best soil for a vineyard in England is such,
 " whose surface is a light sandy loam, and not above a foot and a
 " half or two feet deep above the gravel or chalk, either of which
 " bottoms are equally good for vines, but if the soil is deep, and the
 " bottom either clay, or a strong loam, it is by no means proper for
 " this purpose, for although the vines may shoot vigorously, and pro-
 " duce a great quantity of grapes, yet these will be later ripe, fuller of
 " moisture, and so consequently their juice not mature, nor well di-
 " gested, but will abound with crudity, which in fermenting will
 " render the wine sour and ill-tasted, which is the common com-
 " plaint of those who have made wine in England.
 " Nor is a very rich, light, deep soil, such as is commonly found

“ near London, proper for this purpose; because the roots of these
 “ vines will be enticed down too deep to receive the influences of the
 “ sun and air, and hereby will take in much crude nourishment,
 “ whereby the fruit will be rendered less valuable, and be later ripe,
 “ which is of ill consequences to these fruits, which are known to
 “ imbibe a great share of their nourishment from the air, which,
 “ if replete with moisture (as is commonly the case in autumn), must
 “ necessarily contribute greatly to render the juices less perfect:
 “ therefore great attention should be had to the nature of the soil
 “ upon which they are planted.

“ The next thing necessary to be considered, is the situation of the
 “ place, which, if possible, should be on the north side of a river, upon
 “ an elevation inclining to the south, with a small gradual descent,
 “ that the moisture may the better drain off: but if the ground slopes
 “ too much, it is by no means proper for this purpose: but if, at a
 “ distance from this place, there are larger hills, which defend it
 “ from the north and north-west wind, it will be of great service,
 “ because hereby the sun’s rays will be reflected with a greater force,
 “ and the cold winds being kept off, will render the situation very
 “ warm. Add to this, a chalky surface, which if those hills do
 “ abound with (as there are many such situations in England), it
 “ will still add to the heat of the place, by reflecting a greater quan-
 “ tity of the sun’s rays.

“ The country about this should be open and hilly: for if it be
 “ much planted, or low and boggy, the air will be constantly filled
 “ with moist particles, occasioned by the plentiful perspiration of the
 “ trees, or the exhalations from the adjoining marshes, whereby the
 “ fruit will be greatly prejudiced (as was before observed). These
 “ vineyards should always be open to the east, that the morning sun
 “ may come on them to dry off the moisture of the night early,
 “ which, by lying too long upon the vines, greatly retards the ripen-
 “ ing of the fruit, and renders it crude and ill-tasted. And since the
 “ fruit of vines is rarely ever injured by easterly winds, there will
 “ be no reason to apprehend any danger from such a situation, the
 “ south west, north west, and north winds being the most injurious
 “ to vineyards in England (as indeed they are to most other fruit),
 “ so that, if possible, they should be sheltered therefrom.

“ Having made choice of a soil and situation proper for this pur-
 “ pose, the next thing to be done is, to prepare it for planting: in
 “ doing of which the following method should be observed: in the
 “ spring,

“ spring, it should be plowed as deep as the surface will admit, turning the sward into the bottom of each furrow: then it should be well harrowed to break the clods, and cleanse it from the roots of noxious weeds; and after this, it must be kept constantly ploughed and harrowed for at least one year, to render the surface light; and hereby it will be rendered fertile, by imbibing the nitrous particles of the air (especially if it be long exposed thereto before it is planted): then in March the ground should be well plowed again, and after having made the surface pretty even, the rows should be marked out from south-east to north-west, at the distance of ten feet from each other: and these rows should be crossed again at five or six feet distance, which will mark out the exact places where each plant should be placed, so that the vines will be ten feet row from row, and five or six feet asunder in the rows, nearer than which they ought never to be planted. And herein most people, who have planted vineyards, have greatly erred, some having allowed no more than five feet from row to row, and the plants but three feet asunder in the rows; and others, who think they have been full liberal in this article, have only planted their vines at six feet distance every way: but neither of these have allowed a proper distance to them, as I shall shew: for, in the first place, where the rows are placed too close, there will not be room for the sun and air to pass in between them to dry up the moisture, which being detained amongst the vines, must produce very ill effects: and, secondly, where the vines are placed in exact squares, so near together as six feet, there can be no room for the current of air to pass between them, when their branches are extended on each side, and so constantly the damps in autumn will be entangled and detained amongst the vines, to the great prejudice of their fruit: for since the autumns in England are often attended with rains, cold dews, or fogs, all proper care should be taken to remove every thing that may obstruct the drying up the damps which arise from the ground.

“ The skilful *Vignerons* abroad are also sensible how much it contributes to the goodness of their vines to allow a large space between the rows; and therefore where the quality of the wine is more regarded than the quantity, there they never plant their vines at less than ten feet row from row, and some allow twelve. It was an observation of Bellonius, almost two hundred years since, that in those islands of the Archipelago, where the rows of vines were placed

“ placed at a greater distance, the wine was much preferable to
“ those which were close planted; and this he positively affirms to
“ be the case in most countries where he had travelled. Indeed we
“ need not have recourse to antiquity for the certainty of such facts,
“ when we are daily convinced of this truth in all close plantations
“ of any kind of fruit, where it is constantly observed, that the
“ fruit in such places is never so well coloured, so early ripe, nor
“ near so well flavoured, as those produced on trees where the air
“ can freely circulate about them, and the rays of the sun have free
“ access to the branches, whereby the juices are better prepared be-
“ fore they enter the fruit.

“ Having thus considered the distance which is necessary to be al-
“ lowed to these plants, we come next to the planting: but in order
“ to this, the proper sort of grapes should be judiciously chosen;
“ and in this particular, we have egregiously erred in England. All
“ the vineyards at present planted here, are of the sweetest and best
“ sort of grapes for eating, which is contrary to the general practice
“ of the *Vignerons* abroad, who always observe, that such grapes
“ never make good wine: and therefore, from experience, make
“ choice of those sorts of grapes, whose juice, after fermenting,
“ affords a noble rich liquor; which grapes are always observed to
“ be austere, and not by any means palatable. This is also agreeable
“ to the constant practice of our cyder-makers in England, who
“ always observe that the best eating apples make but poor cyder;
“ whereas the more rough and austere sorts, after being pressed and
“ fermented, afford a strong vinous liquor. And I believe it will be
“ found true in all fruits, that where the natural heat of the sun
“ ripens and prepares their juices, so as to render them palatable,
“ whatever degree of heat these juices have more, either by fermen-
“ tation, or from any other cause, will render them weaker, and less
“ spirituous. Of this we have many instances in fruits: for if we
“ transplant any of our summer or autumn fruits, which ripen per-
“ fectly in England without the assistance of art, into a climate a
“ few degrees warmer, these fruits will be mealy and insipid; so
“ likewise if we bake or stew any of these fruits, they will be good
“ for little, losing all their spirit and flavour by the additional heat of
“ the fire; and such fruits as are by no means eatable raw, are here-
“ by rendered exquisite, which, if transplanted into a warmer cli-
“ mate, have, by the additional heat of the sun, been also altered so
“ as to exceed the most delicious of our fruits in this country.

“ From

“From whence it is plain, that those grapes which are agreeable
“to the palate for eating, are not proper for wine; in making of
“which, their juices must undergo a strong fermentation: there-
“fore, since we have in England been only propagating the most
“palatable grapes for eating, and neglected the other sorts; before
“we plant vineyards, we should take care to be provided with
“the proper sorts from abroad, which should be chosen according
“to the sort of wines intended to be imitated: though I believe the
“most probable sort to succeed in England, is the Auvernat, or
“true Burgundy grape, (which is at present very rare to be found
“in the English vineyards; though it is a common grape in the
“gardens, against walls). This sort of grape is most preferred in
“Burgundy, Champaign, Orleans, and most of the other wine coun-
“tries in France; and I am informed, that it succeeds very well in
“several places to the north of Paris, where proper care is taken of
“their management: so that I should advise such persons as would
“try the success of vineyards in England, to procure cuttings of this
“grape from those countries: but herein some person of integrity
“and judgment should be employed to get them from such vine-
“yards where no other sorts of grapes are cultivated; which is very
“rare to find, unless in some particular vineyards of the citizens,
“who are very exact to keep up the reputation of their wines; no-
“thing being more common than for the *Vignerons* to plant three or
“four sorts of grapes in the same vineyard, and at the time of vin-
“tage to mix them all together; which renders their wines
“less delicate than in such places where they have only this one true
“sort of grape. And here I would caution every one against mix-
“ing the juice of several grapes together, which will cause the wine
“to ferment at different times, and in different manners.

“The cuttings being thus provided, (for I would always prefer
“these to layers, or rooted plants) about the beginning of April is the
“best season for planting; when it will be proper to put the lower ends
“of the cuttings in water about three inches, setting them upright,
“for six or eight hours before they are used; then at the center of
“every cross mark already made by a line, to the distance the vines
“are designed, should be a hole made with a spade, or other
“instrument, about a foot deep, in each of which should be put one
“strong cutting, placing it a little sloping: then the hole should be
“filled up with earth, pressing it gently with the foot to the cut-
“ting,

“ting, and raising a little hill to each about three inches, so as just
“to cover the uppermost eye or bud, which will prevent the wind
“and sun from drying any part of the cuttings, and this upper eye
“only will shoot; the under ones most of them will push out roots,
“so that this shoot will be very strong and vigorous.

“After they are thus planted, they will require no other care until they shoot, except to keep the ground clear from weeds, which
“should be constantly observed: but as the distance between the rows
“of vines is very great, so the ground between them may be sown
“or planted with any kind of esculent plants, which do not grow
“tall, provided there is proper distance left from the vines, and
“care taken that the vines are not injured by the crops, or in the
“gathering, and carrying them off the ground; and this husbandry
“may be continued three or four years, till the vines come to bearing; after which time there should be no sort of crop put between
“them in summer; because the cleaner the ground is kept between
“the vines, from weeds or plants, the more heat will be reflected to
“the grapes; but after the grapes are gathered, there may be a crop
“of coleworts for spring use, planted between the rows of vines; and
“the cultivating these will be of use to the vines, by stirring of the
“ground: but as to watering, or any other trouble, there will be
“no occasion for it, notwithstanding what some people have directed; for in England there is no danger of their miscarrying by
“drought. When the cuttings begin to shoot, there should be a
“small stick of about three feet long stuck down by each, to which
“the shoots should be fastened, to prevent their breaking or lying on
“the ground, so that as the shoots advance, the fastening should
“be renewed, and all small lateral shoots (if there are any such
“produced) should be constantly displaced, and the ground between
“the vines always kept clean. This is the whole management
“which is required the first summer.

“But at Michaelmas, when the vines have done shooting, they
“should be pruned, for if they are left unpruned till spring, their
“shoots being tender (especially towards their upper parts), will be in
“danger of suffering if the winter should prove severe.

“This pruning is only to cut down the shoots to two eyes; and
“if, after this is done, the earth be drawn up in a hill about each
“plant, it will still be a greater defence against frost.

“At the beginning of March, the ground between the vines should
“be well dug, to loosen it, and render it clean: but you should be
“careful

“ careful not to dig deep close to the vines, lest thereby their roots
“ should be cut or bruised; and at the same time the earth should
“ be again laid up in a hill about each plant: but there must be care
“ taken not to bury the two young eyes of the former year’s shoot,
“ which were left to produce new wood.

“ At the beginning of May, when the vines are shooting, there
“ should be two stakes fixed down to the sides of each plant, which
“ must be somewhat taller and stronger than those of the former
“ year; to these the two shoots (if so many are produced) should
“ be fastened, and all the small trailing or lateral shoots should be
“ constantly displaced, that the other shoots may be stronger; and
“ the ground should also be kept very clear from weeds as be-
“ fore.

“ The autumn following, these vines should be pruned again in
“ the following manner: those of them which have produced two
“ strong shoots of equal vigour, must be cut down to three eyes
“ each; but in such as have one strong shoot and a weak one, the
“ strong one must be shortened to three eyes, and the weak one to
“ two; and such vines as have produced but one strong shoot,
“ should be shortened down to two eyes also, in order to obtain
“ more wood against the succeeding year.

“ In the spring, about the beginning of March, the ground be-
“ tween the vines should be again dug, as before, and two stakes
“ should be placed down by the side of all such vines as have two
“ shoots, at such distance on each side of the plant as the shoots
“ will admit to be fastened thereto, and the shoots should be drawn
“ out on each side to the stakes, so as to make an angle of about
“ forty-five degrees with the stem; but by no means should they
“ be bent down horizontally, as is by some practised; for the
“ branches lying too near the earth, are generally injured by the
“ damps which arise from thence, but especially when they have
“ fruit, which is never so well tasted, nor so early ripe upon those
“ branches, as when they are a little more elevated.

“ In May, when the vines begin to shoot, they must be carefully
“ looked over, and all the weak dangling shoots should be rubbed
“ off as they are produced; and those shoots which are produced
“ from strong eyes, should be fastened to the stakes to prevent their
“ being broken off by the wind.

“ This management should be repeated at least every three weeks,
“ from the beginning of May to the end of July; by which means

" the shoots which are trained up for the succeeding year, will not
 " only be stronger, but also better ripened and prepared for bearing;
 " because they will have the advantage of sun and air, which is ab-
 " solutely necessary to prepare their juices: whereas if they are
 " crowded by a number of small dangling weak branches, they will
 " shade and exclude the rays of the sun from the other shoots; and
 " so by detaining the moisture a longer time amongst the branches,
 " occasion the vessels of the young wood to be of a larger dimen-
 " sion; and hereby the crude juice finds an easy passage through
 " them; so that the shoots in autumn seem to be mostly pith, and
 " are of a greenish immature nature, and wherever this is observed,
 " it is a sure sign of a bad quality in the vines.

" The soil also should be constantly kept clean, because if there
 " are any vegetables (either weeds or plants of other kinds) growing
 " between the vines, it will detain the dews longer, and by their
 " perspiration, occasion a greater moisture, than would be, if the
 " ground were entirely clear; so that those who plant other things
 " between their rows of vines, are guilty of a great error.

" In autumn, the vines should be pruned, which season I
 " approve of rather than the spring: and this being the third
 " year from planting, the vines will now be strong enough to pro-
 " duce fruit; therefore they must be pruned accordingly. Now
 " suppose the two shoots of the former year, which were shortened
 " to three eyes, have each of them produced two strong branches
 " the summer past, then the uppermost of these shoots upon each
 " branch should be shortened down to three good eyes (never in-
 " cluding the lower eye, which is situate just above the former
 " year's wood, which seldom produces any thing, except a weak
 " dangling shoot); and the lower shoots should be shortened down
 " to two good eyes each; these being designed to produce vigorous
 " shoots for the succeeding year; and the former are designed to bear
 " fruit: but where the vines are weak, and have not produced more
 " than two or three shoots the last season, there should be but one
 " of them left with three eyes for bearing; the other must be
 " shortened down to two, or, if weak, to one good eye, in order to
 " obtain strong shoots the following summer; for there is nothing
 " more injurious to vines, than the leaving too much wood upon
 " them, especially while they are young; or the overbearing them,
 " which will weaken them so much, as not to be recovered again to

" a good state in several years, though they should be managed with
" all possible skill.

" In March, the ground between the vines should be well dug as
" before, observing not to injure their root by digging too deep near
" them: but where there are small horizontal roots produced on or
" near the surface of the ground, they should be pruned off close to
" the places where they are produced; these being what the *vigne-*
" *rons* call day roots, and are by no means necessary to be left on: and
" after having dug the ground, the stake should be placed down in
" the following manner: on each side of the vine should be a stake
" put in at about sixteen inches from the root, to which the two
" branches, which were pruned to the three eyes, each for bearing,
" should be fastened, (observing as was before directed, not to draw
" them down too horizontally); then another taller stake should be
" placed down near the foot of the vine, to which the two shoots
" which were pruned down to two eyes, should be fastened, pro-
" vided they are long enough for that purpose: but if not, when
" their eyes begin to shoot, these must be trained upright to the
" stakes, to prevent their trailing on the ground, hanging over the
" fruit branches, or being broken by the wind.

" In May, the vines should be carefully looked over again, at
" which time all weak lateral branches should be rubbed off as they
" are produced; and those shoots which shew fruit, must be fastened
" with bafs to the stakes to prevent their being broken, until they are
" extended to three joints beyond the fruit, when they should be
" stopped: but the shoots which are designed for bearing the follow-
" ing season, should be trained upright to the middle stake, by
" which method the fruit branches will not shade these middle
" shoots, nor will the middle shoots shade the fruit, so that each
" will enjoy the benefit of sun and air.

" This method should be repeated every fortnight or three weeks,
" from the beginning of May, to the middle of July, which will al-
" ways keep the shoots in their right position, whereby the leaves
" will not be inverted, which greatly retards the growth of the fruit;
" and by keeping the vines constantly clear from horizontal shoots,
" the fruit will not be crouded with leaves, or shaded, but will have
" constantly the advantage of the sun and air equally, which is of
" great consequence: for where the fruit is covered with these dang-
" ling shoots in the spring, and are afterwards exposed to the air,
" either by divesting them of their leaves, or else displacing their
" branches

" branches entirely, as is often practised, the fruit will become hard,
 " and remain at a perfect stand for three weeks, and sometimes will
 " never advance afterward, as I have several times observed: there-
 " fore there cannot be too much care taken to keep them constantly
 " in a kindly state of growth, as the *Vignerons* abroad well know,
 " though in England it is little regarded by the generality of garden-
 " ers, who, when their grapes suffer by this neglect, immediately
 " complain of the climate, or the untowardness of the season, which
 " is too often a cover for neglects of this nature. And here I can-
 " not help taking notice of the absurd practice of those who pull off
 " the leaves from their vines, which are placed near the fruit: in
 " order to let in the rays of the sun to ripen them; not considering
 " how much they expose their fruit to the cold dews, which fall
 " plentifully in autumn, which, being imbibed by the fruit, greatly
 " retard it: besides, no fruit will ripen so well when entirely
 " exposed to the sun, as when it is gently screened with leaves:
 " and by the pulling off these leaves, which are absolutely necessary
 " to prepare the juices before they enter the fruit, the gross parts of
 " which are perspired away by the leaves, the fruit must either be
 " deprived of nourishment, or else some of the gross particles will
 " enter with the more refin'd parts of the juice, and thereby render
 " the fruit worse than it would otherwise be, were the leaves
 " permitted to remain upon the branches: for if the weak dang-
 " ling shoots are constantly displaced as they are produced, the fruit
 " will not be too much shaded by the leaves that are upon the bear-
 " ing branches.

" When the fruit is ripe, if the stalks of the bunches are cut
 " half through a fortnight before they are gathered, it will cause
 " the juice to be much better, because there will not be near so
 " great a quantity of nourishment enter the fruit, whereby the
 " watery particles will have time to evaporate, and the juice will be
 " better digested. This is practised by some of the most curious
 " *Vignerons* in the South of France, where they make excellent wine.
 " But if, after the bunches are cut, they are hung up in a dry room,
 " upon strings, so as not to touch each other, for a month before
 " they are pressed, it will also add greatly to the strength of the
 " wine; because in that time a great quantity of the watery parts of
 " the juices will evaporate. This is a constant practice with some
 " persons who inhabit the *Thirol*, or the borders of Italy, where
 " is made a most delicious rich wine, as hath been attested by

" Dr.

"Dr. Burnet in his travels; and I have heard the same from several gentlemen who have travelled that road since.

"But with all the care that can possibly be taken, either in the culture of the vines, or in making the wine, it will not be near so good while the vineyard is young, as it will be after it has been planted ten or twelve years; and it will be constantly mending, until it is fifty years old, as is attested by several curious persons abroad, as also by the most skillful wine-coopers at home, who can tell the produce of a young vineyard, from that of an old one, by the colour of the wine, after it is brought to England. This difference is very easily accounted for, from the different structure of the vessels of the plants: those of the young vines being larger, and of a looser texture, easily admit a greater quantity of gross nourishment to pass through them; whereas those of old vines, which are more woody, are more closely constricted, and thereby the juice is better strained in passing through them, which must consequently render it much better; though the grapes from a young vineyard will be larger, and afford a greater quantity of juice: so that people should not be discouraged if their wines at first are not so good as they would wish; since afterward, when the vineyard is a few years older, the wine may answer their expectation.

"The vineyard, being now arrived to a bearing state, should be treated after the following manner: first, in the pruning, there should never be too many branches left upon a root, nor those too long: for although by doing of this, there may be greater quantity of fruit produced, yet the juice of these will never be so good as when there is a moderate quantity, which will be better nourished and the roots of the plants not so much weakened; which is found to be of so bad consequence to vineyards, that when gentlemen abroad let out vineyards to *vignerons*, there is always a clause inserted in their leases to direct how many shoots shall be left upon each vine, and the number of eyes to which the branches must be shortened; because were not the *vignerons* thus tied down, they would over bear the vines; so that in a few years they would exhaust their roots, and render them so weak as not to be recovered again for several years; and their wine would be so bad, as to bring a disreputation on the vineyard, to the great loss of the proprietor.

"The

“ The number of branches which the Italians generally agree to
 “ leave upon a strong vine, are four; two of the strongest have four
 “ eyes, and the two weaker are shortened down to two eyes each;
 “ which is very different from the common practice in England,
 “ where it is usual to see six or eight branches left upon each root,
 “ and those perhaps with six or eight eyes to each; so that if
 “ these are fruitful, one root must produce near four times the num-
 “ ber of bunches that the Italians do ever permit; and conse-
 “ quently the fruit will not be so well nourished, and the roots will
 “ also be greatly weakened; as is the case of all sorts of fruit
 “ trees, when a greater quantity of fruit is left on, than the trees
 “ can nourish.

“ The next thing is, constantly to keep the ground perfectly clean
 “ between the vines, never permitting any sort of plants or weeds
 “ to grow there. The ground should also be carefully dug every
 “ spring, and every third year have some manure, which should be
 “ of different sorts, according to the nature of the ground, or what
 “ can be most conveniently procured.

“ If the land is stiff, and inclinable to bind on the surface, then
 “ sea sand, or sea coal ashes, are either of them very good manure
 “ for it: but if the ground be loose and dry, then a little lime mixed
 “ with dung, is the best manure. This must be spread thin
 “ upon the surface of the ground before it is dug, and in digging
 “ should be buried equally in every part of the vineyard. These
 “ are the most preferable of all manures, for vineyards; so that it will
 “ be worth the expence to procure either of them: and as they re-
 “ quire manuring but every third year, where the vineyard is large,
 “ it may be divided into three equal parts, each of which may be
 “ manured in its turn, whereby the expence will be but little
 “ every year; whereas when the whole is manured together, it will
 “ add to the expence, and in many places there cannot be a suffi-
 “ cient quantity procured to manure a large vineyard in one year.

“ This digging and manuring should always be performed about
 “ the beginning of March, at which time all the superficial or day
 “ roots, as they are called, must be cut off, but the larger roots must
 “ not be injured by the spade, &c. therefore the ground close to the
 “ stem of the vines must not be dug very deep. After this is done,
 “ the stakes should be placed down, one on each side the vines, at
 “ about sixteen inches from their stems, to which the longest bearing
 “ branches should be fastened; and one stake close to the stem, to
 “ which

“ which the two shorter branches should be trained upright, to furnish wood for the succeeding year.

“ In the summer, they must be carefully looked over, as before, rubbing off all weak dangling shoots, and training the good ones to the stakes regularly, as they are produced, and those of them which have fruit should be stopped in June, about three joints beyond the bunches; but the upright shoots which are designed for bearing the following year, must not be stopped till the middle of July, when they may be left about five feet long: for if they are stopped sooner in the year, it will cause them to shoot out many dangling branches from the sides of the eyes, which will not only occasion more trouble to displace them, but will also be injurious to the eyes or buds.

“ All this summer dressing should be performed with the thumb and finger, and not with knives, because the wounds made by instruments in summer do not heal so soon as when stopped by gently nipping the leading bud, which, if done before the shoot is become woody, may be effected with great ease, being very tender while young.

“ When a vineyard is thus carefully dressed, it will afford as much pleasure in viewing it as any plantation of trees and shrubs whatever, the rows being regular: and if the stakes are exactly placed and the upright shoots stopped to an equal height, there is nothing in nature which will make a more beautiful appearance; and during the season that the vines are in flower, they emit a most grateful scent, especially in the morning and evening; and when the grapes begin to ripen, there will be a fresh pleasure arising in viewing them.

“ But as the beauty of vineyards arises from the regular disposition of the branches of the vines, great care should be taken, in their management, to train them regularly, and to provide every year for new wood to bear the succeeding year: because the wood which has produced fruit is commonly cut quite away after the fruit is gathered, or at least is shortened down to two eyes, to force out shoots for the next year, where there is not a sufficient number of branches upon the vine of those trained upright; so that in summer, when the vines are in perfection, there should be six upright shoots trained for the next year's wood, and three or four bearing branches with fruit on them: more than these ought never to be left upon one vine.

"The Auvernat, or true Burgundy grape, is valued in France before any other sort, because the fruit never grows very close upon the bunches, and therefore is more equally ripened; for which reason it should also be preferred in England: though in general, those sorts are most esteemed with us that have always close bunches, which is certainly wrong: for it may be observed, that the grapes on such bunches are commonly ripe on one side and green on the other; which is a bad quality for such as are pressed to make wine."

S E C T. VIII.

Extract of a Letter from M. ROUSSEL in Brie, to M. DU HAMEL, written in the year 1755.

"I Have begun to try the new husbandry upon the vine. It is hard to pay at least 120 livres a year for dressing an arpent of vineyard, to have only our poor wine of Brie; especially when the vines are entirely frozen, as they were last year, or laid bare to the very wood, by hail, as was the case in August last. I am therefore trying to find out a way to manage vines, without being at the expence of dressing, or propping them, and by which they may be less exposed to the injuries of the weather and less liable to be plundered by thieves. To this end, I pitched upon a spot of ground, about half an arpent in extent, which had formerly been a vineyard, but was grubbed up many years ago. I planted on it 400 poplars, six feet asunder, in a quincunx form. As the roots of this tree are few and small, I thought that distance might be sufficient. At the foot of each of these trees, I planted two vine cuttings, one on each side. The alleys are plowed, in order to their being sown alternately, with corn or pulse, such as lentils, beans, barley, oats, &c. the produce of which pays the expence of plowing: whilst the three feet on one side of the tree are sown, the three feet on the other side are plowed at proper times and seasons; by which means, both sides of the tree, and consequently both the vines, receive in turns the benefit of the stirring of the ground. All my plants have taken well. I intend to let the vines run up the trees, without doing any thing to them; and shall wait with patience the event of their produce, which, be it more or less, will be so much clear gain, as it will have cost me nothing. This method was immediately approved
" of

“ of by the country people hereabouts, several of whom are now
 “ following my example. What helped to give them this good opi-
 “ nion of it, so suddenly, was, the example of a vine, which
 “ chanced to grow near this place, in the middle of a field, at
 “ the foot of a pear tree, and which never is either pruned or cul-
 “ tivated. Last year, when all the vines of this country were so
 “ damaged by the frost, as not to produce any fruit at all; this vine
 “ escaped unhurt, and bore as many grapes as yielded a barrel of
 “ wine. If the future produce of my vineyard, which contains
 “ 800 vines, were to be estimated on this footing, it would amount
 “ to 800 barrels of wine every year. But as no one can be so ab-
 “ surd, as to make any such calculation, so, on the other hand, I
 “ believe none will deny but that my vines, producing only the two
 “ hundredth part of that proportion, will yield me four barrels of
 “ wine, which will not have cost me any thing. And even sup-
 “ posing them not to yield me any thing, still I shall lose nothing,
 “ because they will have cost me nothing. The 400 poplars, which do
 “ not stand me in above a penny a piece, (being planted only by slips,
 “ without making or digging either holes or trenches for them,) can-
 “ not fail, in a soil that is quite fit for them, to be worth, twenty-
 “ five years hence, 10 livres a piece, or 4000 livres the whole;
 “ which will be an excellent payment for the ground they will have
 “ taken up. I do not, however, mean to extend this method to
 “ all my vineyards. In most of them, the soil, though fit for the
 “ vine, is too dry and stony for the poplar. In Italy, vines are fre-
 “ quently planted at the foot of mulberry and other trees. The
 “ only thing necessary in that case, is, to make the alleys of a width
 “ proportioned to the shade of the trees.

“ I have begun to cultivate vines with the horse-hoe, and shall not
 “ fail to inform the public of my success in that method.”

S E C T. IX.

*Experiments on the vine, cultivated according to the principles of the
 New Husbandry, with remarks thereupon, by M. de Chateau-vieux.*

WHEN I began to reflect attentively on the principles of the
 new husbandry, I soon perceived that it might prove a means
 of perfecting the culture of our vineyards, as well as that of our
 other lands.

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I was the more readily induced to turn my thoughts towards that important branch of agriculture, as it seemed to me to have been too much neglected for a long time. I plainly saw that our methods of cultivating the vine were, in general, not only defective, but badly executed, and that, in the common way of planting vineyards, the produce could not be proportioned to the great expence.

I shall not at present enter into a detail of the principles and motives of my new scheme for the culture of the vine: that task would be too long for this work: and I should be likewise glad first to see the advantages of my method confirmed by a series of experiments repeated for several years together. My different operations, and first success, are all that I shall mention now.

Every country has, in the culture of the vine, some practice or other peculiar to itself, and which is thought essential there, though it be rejected in other places. All agree in pruning the vine, and in stirring the earth round it: but neither of these operations is performed in the same manner every where.

For the better understanding of my new culture, it is necessary that I should give an idea of the manner in which our vineyards are laid out and planted. Their exposition is generally to the East or South, on a good deep soil, which has a gentle declivity, or on the side of a hill. The whole surface of the ground is planted without order or symmetry; so that the vines are, almost always either too close together, or too far asunder: very few are at proper distances. As the old vines decay and perish, the chasms are filled up by layers from the next neighbouring vines. This is the general disposition of our vineyards, from which great inconveniences must necessarily arise; but I shall not enter into a detail of them.

With regard to the culture of the vine, it is sufficient, for my present purpose, to observe, that the whole of that labour is now performed by hand, which renders it very expensive. I say nothing of the manner in which it is executed; that part having appeared to me so very defective, that I have been obliged to alter and correct it in every point.

By this short preamble, it may easily be seen, that in order to improve the culture of the vine, and bring it to greater perfection, it was necessary that I should attend chiefly to the three following things. 1. To dispose the vines in a better manner, by planting them in strait lines, and at equal distances from each other. 2. To contrive

contrive that disposition, so as to lessen the present expence of culture, by using a plough to stir the ground in one part of the vineyard, whilst the other should continue to be stirred with the spade.

3. To execute the several cultures of the vine, in such manner as to make them promote its vegetation more than they do in any of the common methods.

I shall treat each of these three articles separately.

I. Of the disposition of the Vines in the vineyard.

THE disposition which seemed to me the most agreeable to the principles of the new husbandry, by which I was guided, was to lay the vineyards out in beds, as we do fields for corn, observing to leave an alley between every two beds, and making each bed five feet wide, in order to plant it with three rows of vines, which, by that means, would be 30 inches asunder, and the vines at the same distance from each other in the rows.

As to the alleys, I thought it would be right to make them also five feet wide: and what I shall say hereafter will shew, that about that width is necessary.

However, as that disposition might not be the best, I tried others on small spots of ground, by planting the vines at other distances. Some were planted in single rows three feet and a half asunder; others in double rows, and in beds, with alleys of three feet and a half between them. These plantations were made in the spring of 1753.

But as I could not expect to see the event of these trials, till a considerable time after making them, eight or ten years, at least, being requisite to shew what the success would be, when the vines should be come to their full strength and bearing; I considered at the same time, by what means I might abridge an experiment which was to be of so long a duration.

To that end, I formed a bed of vines, in a vineyard planted 24 years before. The vineyard was good, and yielded plentiful crops. I made my bed five feet wide, and planted it by laying down stocks of the old vines, to make the two outward rows, leaving two feet and a half distance from one layer to another. The old vines, which happened to be pretty well situated, formed the middle row. The remainder of the bed, which is 40 perches long, was planted with layers.

An alley, five feet wide, was made on one side of this bed, by plucking up the old vines within that distance. Some of these, which were left, served to form a row of vines, ready against the making of a second bed parallel to the first. It is plain, that the making of a bed in this manner, requires a width of ten feet, viz. five feet for the vines, and five feet for the alley. This bed was made, in this manner, in November 1752.

After I had seen the crop which it produced in 1754, I no longer hesitated to extend the experiment: and accordingly, in November, I made three other beds, like the former, and close to it.

I not only made no doubt but that the vines, being so disposed, and having an equal quantity of earth to draw their nourishment from, would thrive better than they do in our common method of culture; but I likewise hoped that their being exposed on all sides to the influences of the sun and air, by means of the alleys, would facilitate their vegetation, and hasten the ripening of the grapes.

II. *Of the importance of lessening the expence of culture, by the new disposition of the vines.*

THIS article will be of no great consequence to those who are already used to cultivate their vineyards with the horse-hoe: I write it for those only who are not acquainted with that practice.

The manner in which I propose distributing the vines, shews at once the possibility and facility of giving the alleys every necessary culture, with the same plough and the same cultivator that we use for the alleys of our corn fields. I have not found the least difficulty in the execution of this practice.

The ground thus cultivated in the alleys, will be about a third part of the whole: the remaining two thirds will continue to be cultivated by hand, as usual; and the expence will be considerably diminished, by the dispatch with which the ploughs, or cultivator, will perform their part.

The plough may be brought as near the vines as one pleases, provided care be taken not to damage them. An expert husbandman will easily know how to manage in that respect.

Another diminution of the expence attending the common culture of vineyards is, that as, by the method which I propose, the number of vines will be fewer, they will of course require less labour, and there-

therefore less cost, and the vine-dressers meeting with no hinderances or obstructions between the vines planted regularly in rows, will do more work in a day, and that much better, than in the old way. There will also be less occasion for many things necessary to the vine, such as propping, tying up, dunging, &c. Consequently this new culture will prove a considerable saving.

It is well known how much vines are hurt when too great a quantity of water is retained in the ground. It chills them too much, their juices become less exalted, numbers of weeds spring up, &c. These inconveniences will be remedied in a great measure by means of the alleys, by cutting with the plough, as I have done, towards the beginning of winter, a furrow along the sides of the bed. The water will drain off into that furrow, and the bed will retain only the degree of moisture necessary for the vines.

III. *Of the means of rendering the culture of the vine more beneficial to the plant and its fruit.*

I shall speak only of the two principal parts of the culture of the vine, viz. the pruning of it, and the stirring of the ground; and at what time each of these ought to be performed.

Before I began to execute the alterations I had thoughts of making in this culture, I had endeavoured to make myself so far master of it, as to be the less in danger of miscarrying in my experiment.

The custom of this country is, to prune the vine during and after winter; frequently beginning that work about the end of January. I always thought that a wrong season; and judged that it would be much better to prune the vine before winter, immediately after the vintage is ended. Experience has since shewed me that I was right.

In November 1750, I pruned above fifty vines with my own hands: none of them suffered in the least by the winter's frosts: they made strong and vigorous shoots, and produced a greater quantity of grapes than any of the neighbouring vines.

The next year, and in the same month, I pruned the same vines again. This pruning had the same effect as the year before. Encouraged by this repeated experience, I determined to make the bed I mentioned before, in my old vineyard. The vines have continued to be pruned before winter, always with success, and without any sort of inconvenience.

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Satisfied with these first trials, I thought I might safely venture to extend the same practice to larger tracts of ground. I had about two acres of vines, which had produced very little wood for two years past. The branches were so poor and slender, that they would scarce bear laying down: in short, the vineyard perished daily. I conceived hopes of recovering it by means of this pruning. Accordingly, I pruned it in November 1754; and in 1755, the vines produced stronger and longer shoots. As the branches would then bear laying down, I began to replenish part of the vacant places. By this means, my vineyard was replanted with young vines, and quite renewed, only by altering the time of pruning.

This last pruning underwent a severe trial, from the excessive hard frosts of the winter of 1755: yet, intense as the cold was, my plants bore it, without being hurt at all. I then looked upon it as certain, that the vine might be pruned before winter, without any danger from the inclemency of that season.

It was absolutely necessary that the vine should bear pruning at that time, in order to enable me to perform the other cultures in their proper and most favourable seasons.

That the vine may be benefited as much as possible by every stirring of the earth about its roots, those stirrings ought certainly to be performed at the times when they may be most likely to excite the greatest vegetation. Let us see whether the common practice answers that end. The usual time of beginning to dress the vineyard, is in the spring, immediately after pruning the vines. Three dressings are judged sufficient, and it is generally thought that the last should be finished by midsummer. The plants are then left to shift for themselves, till the time of vintage, which is upwards of three months after. During that time, quantities of weeds generally shoot up, which shade the vines, and hinder the grapes from ripening as they ought. Careful husbandmen pull them up: but the greater part are unwilling to take that trouble.

In the common way of cultivating the vine, the earth is first stirred when the buds are just ready to come out, and even after they are come out: a time always extremely critical, because the uncertainty of the season exposes the buds to several dangers, which are increased by that stirring of the earth, from whence many exhalations, oftentimes very pernicious, proceed at this season. Would it not be much better to let the vineyard rest while the vine is budding?

The last stirring, which is given about midsummer, is too long before the vintage, and therefore is almost always followed by great quantities of weeds. Might not this last culture be performed later?

I have experienced that these inconveniences may be avoided, without falling into others. To this end, after the vine has been pruned, before winter, let the earth be first stirred in that season: the second stirring, which would otherwise be immediately after winter, may then be deferred till towards the end of May: and the third stirring may be given in the beginning of August, or about the end of July.

This has been my method of cultivating my vines, ever since their being planted in beds. The beds are dug by hand, and the alleys are stirred with the plough or the cultivator.

The first stirring before winter produces the same effect on the vineyards, as it does on our beds of corn. The water is drained off and the winter's frosts penetrate the earth, divide it, and keep it loose and light.

It remains in this state till towards the end of May, when it receives the first stirring after winter: and, to have a more certain rule to go by, the second stirring should not be given till after the props have been stuck, the vines have budded, and the shoots have been tied up to the props. This stirring may be given either a little sooner, or a little later, than is mentioned above, according to the season. Sometimes one may be obliged to hasten it, if the ground is greatly burdened with weeds: but at whatever time it be performed near the end of May, it is certain that the vine will then have made great shoots, and that without having been disturbed by any stirring of the earth during the time of its tender vegetation. As I have tried this culture in hot and very dry years, I have seen that the earth has not grown hard, but has retained the necessary degree of moisture, so as to be stirred with the greatest ease.

The third stirring, which is the second after winter, being deferred till towards the end of August, or at least till the end of July, weeds have not time to grow in any quantity between that and the season of the vintage: and what will render it still more beneficial, is, that this is the time when the grapes fill most, and are drawing towards a state of maturity.

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I may perhaps be thought not to enlarge enough on so important a subject as this. It will, I confess, require being treated more fully hereafter: but in the mean time I beg the reader to consider, that I am now relating only the success of my first trials.

SECT. X.

Good effects of this culture proved by the produce of a bed of vines forty perches long, planted in 1752.

I Observed, in the beginning of this article, that every culture of the vine is performed with much greater ease and expedition in vineyards laid out in beds, than in those which are planted all over, but at random. The very situation of the vines planted regularly in beds, is sufficient to shew with what ease every thing that they require may be done, and that they must, of course, be well cultivated in every respect.

In the next place, the pruning of the vine, and the first stirring of the earth before winter, are done at a time when the business of the field is over, and husbandmen are, in some measure, un-occupied. That time, which would otherwise be in a manner lost, may now be employed to very great advantage; and in consequence of their being advanced in their works, before the coming on of winter, instead of being over loaded in the spring, by a multitude of things to be done at that time, they will have ample leisure to attend properly, and without being hurried, to every branch of culture that a farm requires.

The effect of our culture has been extremely visible. The new vines have grown so prodigiously, that they now greatly surpass those of the old vineyard, which they were part of: the shoots too are thicker and longer, and the bunches of grapes bigger and in greater number.

When I first began to apply the principles of the new husbandry to the culture of the vine, I hoped indeed that the great fruitfulness of a smaller number of plants, might compensate for the loss of those I was obliged to retrench: but I was agreeably surprised to find all the vines of my bed loaded with an equal quantity of grapes.

Tho' my conjecture was founded on principles which I knew to be true, I was still farther confirmed in my opinion by an observation

tion I had made, that, even in our best vineyards, there are always great numbers of vines which absolutely bear no fruit at all, and many others which produce but very little; so that it is not on the great number of plants that the great produce of the vineyard depends, but on the goodness of those plants.

Accordingly, I concluded, that I ought not to look upon my having taken up some vines in order to form the alleys, as a loss, provided those in the bed were enabled by good culture to yield their utmost productions. The event shewed that I was right.

I likewise judged, that the grapes would ripen more perfectly in this new way, than in the old: and in that too I was not mistaken; for they were much higher flavoured, and made far better wine.

Besides these advantages, this culture preserved my vines from a very bad accident, which happens frequently, especially when the autumn is rainy: I mean, the rotting of the grapes. In our common vineyards, the grapes ripen, smothered beneath that quantity of leaves with which the vines are loaded, and surrounded by numbers of weeds, which often grow higher than the vines themselves. Add to this, that the air round them is filled with various exhalations from the earth, which, for want of a free circulation, remain suspended about the plants. These causes cannot but make the grapes rot, and the wine that is made of them, must be greatly inferior to what it would otherwise be.

Our vines in beds, being much less, if at all, liable to any of these accidents, will have the advantage of preserving their grapes sound and without rottenness, till they are perfectly ripe. This I have already experienced, at a time when above half the grapes of my old vineyards were absolutely rotten.

Notwithstanding all the advantages of this new method, which, I may say, I have only glanced at; they would probably not be regarded, if they were not attended with greater fruitfulness than is obtained in the common way. I shall therefore shew, that the produce of my young vines was very considerable, and greatly superior to that of my old vineyard.

My bed, as I observed before, was formed in November 1752; and the two outward rows consisted, in a great measure, of young layers, which not being old enough in 1753, to bear much fruit, I could not expect any great matter from them that year. However,

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they bore as much as could reasonably be desired. A violent storm of hail which fell in June, left scarce any thing to be gathered in all our other vineyards.

The year 1754, produced, in general, but little wine. The young plants of my bed, being only in their second year, were too weak to distinguish themselves by any extraordinary quantity of fruit; tho' their vigour gave great hopes for future years. However, even in this, they were loaded with so many and so large bunches of grapes, that they yielded rather more wine than the old vines which were next them.

The year 1755, was one of the best years for vine, that has been known for a long time. The quantity was plentiful, and the quality exceeding good. The youngest plants of my bed, which were only in their third year, seemed no ways inferior to the old vines cultivated in the common way.

This bed, 40 perches long, and 10 feet wide, including the alleys, contained 66 square perches. It yielded three hundred and thirty-six pints of wine, Paris measure*, which was after the rate of two-fifths more than I had from my old vineyard; or to explain myself still better, if my whole vineyard had been laid out in beds, it would have yielded five barrels of wine, for every three that it did yield.

Twenty beds of the size we are speaking of would make near an acre and a quarter: that is to say, they would contain 1320 square perches; and those twenty beds, supposing them all to produce alike, would, after the rate of this, yield 6720 Paris pints, or 23 hogsheads and 96 pints; which, in this country, is a prodigious quantity, such as no vineyard here has ever yet produced.

The vintage of 1756, was neither plentiful nor good. I therefore did not make any comparison; but remained satisfied with observing in general, that my bed produced at least as much as the old vineyard.

* Nearly equal to the same Number of English quarts, wine measure.

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SECT. XI.

General Directions for making Wine.

AFTER the above accounts of the culture of the vine, it may not be improper to give some general directions for making wine. As it would be foreign to our purpose to enter into a detail of the several methods now used, we refer the curious to what Mr. Miller has said on that head, in the article *Wine*.

The grapes must be of a proper degree of ripeness, because the juice of un-ripe grapes, or other fruit, is a rough acid liquor, which is with great difficulty made to undergo a vinous fermentation. In some instances, as in verjuice, it will remain in the same state for years together: but after the grapes are come to a due maturity, the juice is no sooner pressed into a vessel, than it ferments, and becomes wine.

Some kinds of grapes are naturally of this austere acid quality, which prevents their fermenting kindly. It has been found by experience, that this may be corrected by the mixture of such substances as correct the acid: for instance, the fixed alkaline salt of plants, in a due proportion, chalk, crabs-eyes, or other absorbent bodies.

Some gentlemen in England and America, when the juice of their grapes have not fermented kindly, have obtained a very good wine, by exposing the containing vessels, in a warm situation, to the sun, with an intention of turning it to vinegar. Chymists know that all vegetable acids are volatile in certain degrees of heat. Perhaps the effects of this summer exposure may be the evaporation of the acid, and thereby the conversion of the whole to a mild vinous fluid. There are not instances wanting of the roughest verjuice being turned to a strong pleasant cyder, or vinous fluid, by means of a warm situation accidentally given it.

When the juice is too watery, the addition of sugar, raisins, or whatever can give it a due consistence, will correct this quality; as is frequently experienced in the juice of currants, gooseberries, &c. It is likewise a frequent practice in making cyder, to set the juice of the apples, when it is found too watery, in broad shallow vessels, over a fire, where it is kept in a considerable degree of heat (but

not suffered to boil,) till the superfluous moisture is evaporated. Might not the same method be practised to advantage in the making of wine?

Mr. Miller says, that if the stalks of the bunches are cut half through about a fortnight before they are gathered, the juice will be rendered much richer; because not near so great a quantity of watery nourishment will then enter the fruit. "This, continues he, is practised by the most curious *Vignerons* in the south of France, where they make excellent wine. If, after the bunches are cut, they are hung up in a dry room, upon strings, so as not to touch each other, for a month before they are pressed, it will also add greatly to the strength of the wine; because, in that time, a great quantity of the watery parts of the juices will evaporate. This is a constant practice with some persons who inhabit the Tyrolèse, where is made a most delicious rich wine, as hath been attested by Dr. Burnet, in his travels."

The acidity and wateriness of the juice of the grapes may be likewise remedied by a proper culture of the vine. If the heat of the climate is not great enough to ripen the grapes, especially in cold rainy seasons, the warmest and driest situations and soils should be chosen for the vines. A free and open exposure, whereby the sun may have access to the vines, might perhaps bring the wild vines in America to ripen their fruit, and exalt its juice to a much higher flavour. Mr. Miller, therefore, judiciously advises the people of America to plant their vines on rising grounds, where the bottom is rocky or hard near the surface.

The grapes in America are liable to burst; which Mr. Miller imputes, either to the too great moisture of the air in that country, or to their receiving too much nourishment from their over rich soil. Gentlemen of America think their air, except in marshy countries, is drier than ours, and are therefore of opinion that the bursting of their grapes is not owing to the too great moisture of the air. If it proceeds from too much nourishment, the remedy would seem to be easy: *viz.* training up a greater number of branches to consume that nourishment. Others, perhaps with more reason, impute their bursting to their ripening too early, while the heavy rains, frequent in autumn, fall. In this case, they may be trained up against lofty trees. The reflection of the heat, from the earth, would then be less, and the leaves of the trees would shelter the grapes from the sun. By this means, being later before they

they fill, they would not be so apt to burst; and as the latter end of the autumn is generally fair, they may then have an opportunity of coming to their full maturity, without the danger of bursting. Or if it is thought more advisable to quicken their ripening, the warmest soil and situation should be chosen for the vines, and they should not be permitted to rise to a great height.

We have sometimes been inclined to think that the summer pruning of the vine, which is intended to hasten the ripening and increase the goodness of the grapes, has the contrary effect.

In the spring, and while plants are in a growing state, their juices are of a watery acid nature, abounding in what the chemists call their native salt. As the summer advances, or as, respectively in each, their seed or fruit begins to ripen, their juices lose that saline watery state, and become gradually milder: and when their seed or fruit is come to full maturity, the juices of perennial plants become of an oily mucilaginous quality. This change in the nature of the juice of plants is gradual, and perfect in proportion to the flourishing state of the plant. If the vines are pruned while they are yet in a growing state, nature is checked in bringing about this change: for not being able to extend the branches farther in length, the buds for the next year swell, and shoot out; whereby a new vegetation is brought on, and the juices are kept longer in their saline state. Surely, as in animal digestion, the more perfect and strong the powers of the animal (or plant) remain, the higher and more perfect must its juices become.

When the grapes are too ripe, or the weather continues too warm at the time that the grapes must necessarily be gathered, their juice is apt to ferment too much and too quickly, whereby the vinous spirit is evaporated, and the liquor becomes vapid. To remedy this, in countries liable to much heat, there should be cool places built for carrying on this fermentation. A gentleman, who had no such conveniency, contrived the following method to supply the want of it. Near his house was a spring, the water of which he conveyed by pipes into a cellar of an out-house; and when he had a mind to check the fermentation, he raised the water in the cellar to what height he found proper, so as to cover the whole or part of his vessels. If the vessel was entirely immersed in the water before the liquor had begun to ferment, he found that it continued in the same state for months. Thus, having pressed some apples, and having immediately immersed the containing vessel in his cellar, he let it
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remain there till the spring, when, on his carrying it into a warmer place, it fermented, and became excellent cyder. Mr. Boyle relates a parallel instance, in his *History of Gold*.

In some countries, they make it a general rule to gather their grapes when dry; and in others they as carefully gather them only when they are wet with dew. In both, the circumstances of the seasons should, perhaps, vary this custom. Thus, when a warm kindly season has brought the grapes to a due maturity, such juice wants no addition: if a dry season has perhaps thickened their juice too much, the dew may remedy that defect: and if a cold or rainy season has prevented their ripening thoroughly, and they still continue in an acid watery state, surely the warmest and driest hours should be chosen for gathering them.

We cannot here help lamenting the want of experiments performed with accuracy and judgment on this subject.

When the grapes are to be gathered, a sufficient number of labourers should go into the vineyard, each provided with a basket and knife, and cut, as close as possible to the fruit, those bunches only which appear ripest and most open; leaving for a future cutting such as are green, or close: for close bunches never ripen thoroughly. All rotten or bursten grapes, whether occasioned by over-ripeness or any other accident, should also be avoided. The bunches thus gathered should be laid gently in the baskets, without bruising or pressing them. The more expeditiously they are gathered, the finer will be the colour of the wine, and the sooner they are pressed, the better will its quality be.

For white wine, the grapes should be put immediately in the press, which, being let down upon them, will, by its weight alone, force out the liquor plentifully. This first running is esteemed the most delicate. When the liquor ceases to run, the press is raised, and the cakes of grapes round its sides are pared off with an iron shovel made purposely for that use, and thrown up again, together with the loose scattered grapes. The press is then let down again on them, and screwed with great force, which occasions a second running more plentiful than the first, and little inferior to it in flavour or colour; but preferable in this, that it has a stronger body, and will keep a considerable time longer. This operation is repeated, whilst any juice remains in the grapes.

To make red wine, after the red grapes are gathered, in doing of which the same caution should be observed as before, in regard

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to their ripeness, &c. the bunches are thrown into large tubs, and there mashed or bruised to pieces, with sticks, or by putting children into the tubs to tread out their juice. This is repeated, till the vessel is full: after which the grapes are let lie in their liquor 48 hours, during which time the whole must be frequently stirred together. This stirring raises a fermentation, and increases the colour of the wine, which becomes of a full bright red. The liquor thus obtained, is then poured off, and is higher flavour'd than that which is afterwards got by pressing what remains at the bottom of the tubs: tho' this last will have the strongest body, especially if the press be screwed so tight as to break the seeds of the grapes.

The grapes that were left upon the vines at the time of the first cutting, should be gathered as they ripen; and so on, to a third and other cuttings, according as it may be found necessary.

After the grapes have been pressed as dry as possible, their cakes, or husks, diluted with water, and fermented, will afford a spirit, by distillation.

The new wines will generally ferment of themselves, within a few days after they have been put into the casks. Those that do not, should be helped, by putting into them a little of the froth, or yeast, that works from the others. The finest wines will ferment the soonest: and this fermentation will continue for about ten or twelve days, according to the sort of the wine, and the season of the year.

While the wine ferments, the bung-hole of the cask must be left open, or only covered with a thin cloth, to prevent any dirt from falling in: and this cloth should be laid hollow, so that the froth arising from the fermentation may have room to work off.

When the fermentation is pretty well over, which is known by the froth's ceasing to rise so fast as before, the bung may be closed down, after filling up the cask with liquor within two inches of the top. A vent-hole should then be opened and left, to carry off whatever may be thrown up by any subsequent fermentation. This filling up of the cask to within two inches of the vent-hole, should be regularly observed every two days, for about ten or twelve days running: for the fermentation will continue a considerable time, though in a less degree; and if your casks are not kept so full as that the foulness thrown up by the fermentation may be carried off at the vent-hole, it will fall back again into the wine, and render it foul and muddy. After filling up each cask in this manner, to
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within two inches of the bung, for about ten or twelve days, it must be filled to within an inch every five or six days, for the space of a month; after which, once a fortnight will be sufficient during the next three months.

Tho' the fermentation will be over long before this last mentioned time, yet the casks must be filled up once a month, so long as they continue in the cellar: for as the wine will waste insensibly in the casks, it will grow flat and heavy, if they are not kept continually filled up. 'Twere needless to say that the vent holes must be stoppt, when the fermentation is over.

In several parts of Germany, where their grapes, seldom coming to full maturity, are gathered somewhat green, they have iron stoves in their cellars, where they keep a constant fire, which, by rarefying and heating the air, ripens and meliorates the wines, and renders them much more palatable and agreeable than they would otherwise be: keeping the wines in places considerably warmed either by the sun or fire, (as observed in page 411) will have the same effect, even so late as in the summer after the vintage: for these acid liquors remain long without fermenting thoroughly, or putrifying.

As the wines drawn from the last gathering of the grapes cannot be so perfect as the others, for want of due maturity in the fruit, the people of Champaign and Burgundy have recourse to the following method, to accelerate their ripening. When the wines have been about three weeks in the casks, they roll them up and down therein for some time, five or six times a day, for four or five days running; then two or three times a day, for three or four days; afterwards, once a day, for about four days; then once a day, for about a week; and after that, once in four or five days. If the grapes were gathered very green, the rolling in this manner is continued, in all, for about five or six weeks: but if they were tolerably ripe when gathered, rolling once in four or five days, for about a month or six weeks, will be sufficient. This rolling of the liquor in the casks will heighten the fermentation, by the agitation of its parts; and the violent motion thereof heats the wine, which causes it to purify and purge itself, and accelerates its ripening, much better than any other method can do. It likewise sweetens and strengthens it, by mixing and shaking it together with its lees, and renders it much more palatable. The same method is also practised when the wine is of too weak a body.

About the middle of December, the wines may be drawn off from the lees into fresh casks, for the first time, taking care to fill

the casks up, and to place them so that they may not be shaken or disturbed, until the middle of February, when it will be right to draw them off again into other casks, which should likewise be filled up, and kept where they may not be disturbed, till the latter end of March, or the beginning of April, at which time it will be proper to shift them again into other casks.

When the wine is fit for bottling, a frosty day, if the season of the year will permit, or, for want of that, a cool and dry one, should be chosen: experience having shewn that wine drawn off either on a hot, or on a cold and moist, or a rainy day, will never be so fine as that which is bottled in clear settled weather. The same rule should be observed in shifting the wine from one cask to another.

We shall close this article with a few directions, which Mr. Miller tells us have occurred to him from some observations and experiments more particularly relating to the making of wine in England.

The grapes, says he, being ripe, should be cut when they are perfectly dry, and carried into a large dry room, where they should be spread upon wheat straw, in such manner as not to lie upon each other. In this place they may remain a fortnight, three weeks, or a month, according as there is conveniency; observing to let them have air every day, that the moisture perspired from the grapes may be carried off. Then, the presses and other things being in order, all the grapes should be pulled off the bunches, and put into tubs; taking care to throw away such as are mouldy, rotten or not ripe, which, if mixed with the others, would spoil the wine: the stalks of the bunches should also be thrown away: because if they are pressed with the grapes, an austere juice will come from them, which will render the wine sharp and acid. Mr. Miller is of opinion that the want of this precaution has spoiled great quantities of wine made in England, which might otherwise have proved very good: for, as he rightly observes, in France, and other wine countries, those who pay more regard to the quality than the quantity of their wines, always pick the grapes from off the stalks before they are pressed: much more ought we in England, where the climate is less favourable, not to omit any art which may be necessary to help the want of sun.

The grapes, being thus carefully picked, should be well pressed. If red wine is intended to be made, the husks and stones should be

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put

put into the liquor, and if the seeds or stones of the grapes are broken in the press, the wine will be the stronger. The liquor and husks must be put into a large vat, where the whole should ferment together five or six days; after which the wine should be drawn off, and put into large casks, leaving the bung hole open to give vent to the air which is generated by the fermentation. If the wine, after it is pressed out, and put into the vat with the husks, does not ferment in a day or two at most, it will be proper to add a little warmth to the room, by fires, which will soon put it into motion. For want of this, it often happens, where people press their wine, and leave it to ferment in open cold places, that the nights, being cool, check the fermentation, and cause the wine to be foul, and almost ever after upon the fret.

If white wine is desired, the husks of the grapes should not remain in the liquor above twelve hours, which will be long enough to set it a fermenting: and when it is drawn off, and put into other vessels, it should not remain there above two days before it is drawn off again; and this must be repeated three or four times, which will prevent its taking any tincture from the husks in fermenting.

When the greatest fermentation is over, the wine should be drawn off into fresh casks, which should be constantly filled up, as before directed, and the bung-hole be left open three weeks or a month, to give vent to the generated air, and room for the scum to run over. In filling up the casks, great care should be taken not to break that scum, because it would mix with the wine, make it foul, and give it an ill taste. The best way therefore is, to have for this purpose a funnel, with a plate at the small end, bored full of little holes, that the wine may pass through in small drops, so gently as not to break the scum.

After the wine has remained in this state a month or six weeks, it will be necessary to stop up the bung-hole, lest, by exposing it too much to the air, the liquor should grow flat, and lose much of its spirit and strength: but it must not be stoppt quite close, but should rather have a pewter or glass tube, of about half an inch bore, and two feet long, placed in the middle of the bung-hole. The use of this tube is to let the air, which is generated by the fermentation of the wine, pass off; because being of a rancid nature, it would spoil the wine, if it were pent up in the cask: and in this tube there
may

may always remain some wine, to keep the cask full, as the wine therein evaporates and subfides.

The reverend Dr. Hales has greatly improved this tube, by making it double, *viz.* by having within the outer tube, which he directs to be made two feet long and of about two inches bore, and to be fixed in the bung-hole by a pewter socket closely cemented, another smaller tube, of about half an inch bore. The lower tube should always be kept about half full of wine, which will supply the vessel as the wine therein shall subside; and there will be no room left in the upper part of the vessel, to contain any generated air, which will pass off through the upper small tube, which must always be left open for this purpose. As the wine in the lower tube subfides, it may be re-filled by introducing a slender funnel through the small tube, down to the scum upon the surface of the wine in the larger tube, so as to prevent its being broken by the wine falling too violently upon it. Dr. Hales adds, that if this experiment is tried with glass tubes, it will give an opportunity to observe what impression the different states of the air have upon the wine, by its rising or falling in the tubes: and if that succeeds, it may afterwards be done with wooden or metal tubes, which will not be in danger of breaking.

After the wine, and particularly that of countries where the sun is not very powerful, has passed its fermentation in the vat, and is drawn off into the casks, it will require something to feed upon. To this end, it will be right always to preserve a few bunches of the best grapes, which may be hung up in a room till there be occasion for them; when they should be picked off the stalks, and two or three good handfuls put into each cask, according to its size.

The larger the casks are, the greater strength the wine contained in them will acquire; and consequently it will be the less in danger of suffering from the injuries of the weather.



A
PRACTICAL TREATISE
OF
HUSBANDRY.

PART IV.

Of the Instruments peculiar to, or useful in, the
NEW HUSBANDRY.

CHAP. I.

Of PLOUGHS.



IN our account of the experiments in 1750, we advised, says M. Duhamel, making the first trials of the new husbandry, on small pieces of ground, in order to acquire by degrees a knowledge of many circumstances, which, though they may seem of little consequence, are, in reality, of great importance. If those experiments had been made at once on large tracts of land, any bad success at first setting out, might have discouraged people from making farther trials.

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We find with pleasure, continues our author, that a sufficient number of experiments has now been made, to create a confidence in this new method of cultivating land, and that proper instruments for that purpose have been invented. It therefore remains that we give a description of these instruments, beginning with the ploughs.

Two things are essentially necessary to all ploughs: the one is, that the share and coulter should enter sufficiently deep into the unplowed earth, to turn it over into the furrow: the plough is fitted for this purpose, by having its share and coulter placed in a direction somewhat oblique to the beam, inclining towards the ground that is to be turned over: and the other, which is still more important, is, that the plough be made to pierce to a depth suited to the quality of the soil. This is easily effected with ploughs, that have a fore-carriage: and as to those which have none, the plowman may, by the help of their handles, if sufficiently long, as with a lever, make the share pierce to whatever depth may be thought most proper.

M. de Chateau-vieux observes, that, in order to plow well, the furrow which is turned over ought not to be cut too wide: The breadth of it should be determined by the quality of the soil, according as it is stiff or light, dry or moist. His furrows are generally between eight and nine inches wide: and as to their depth, he is guided in that respect by the nature of the soil. Sometimes he has plowed a foot deep; but then the furrows were cut narrow, in order to proportion the resistance of the earth, to the strength of the horses: for it is as easy to them to plow twelve inches deep, with a narrow furrow, as it would be to plow only to the depth of six inches, with a wider one.

M. Duhamel took the first hint of his plough, from one that he saw near Rochefort, the whole fore-carriage of which consisted of only one very small wheel, whereby the beam was supported at a proper height. While this plough was making, he received M. de Chateau-vieux's description of his: but too late to follow entirely the ideas of that gentleman. However, he was still in time to make some alteration in his fore-carriage, by means of which, he thinks his plough has all the advantages of M. de Chateau-vieux's, and that it is even more convenient in some respects. We, with M. Duhamel, shall leave the public to judge which of the two is best, after giving a drawing and description of each of them.

S E C T. I.

*Description of M. de Chateau-vieux's plough.**Of the Plough head.*

THE head of this plough is composed of a wheel 32 inches in diameter, which may be extended to 34 inches, or reduced to 30: but to fall short of, or to exceed those measures, would be attended with inconveniencies. This wheel may be made very light, especially if it be incircled with a thin hoop of iron. It is represented in *Plate II. fig. 1, 2, 3.* of which, *fig. 2,* is the plan, and *fig. 1,* the profile.

The frame in which the wheel is placed, is formed by two shafts *AB, CD, fig. 2,* distant from each other 18 inches, from inside to inside; which fixes the length of the nave of the wheel. These shafts are four feet eight inches long, and may be reduced to four feet four inches, by shortening them at the ends, *C* and *A*. They are about two inches and a quarter square: but the edges should be rounded off. These two pieces are fastened together by the two cross staves *EF, GH,* which are two inches and a half wide, and about an inch thick. They are riveted to one of the shafts, at *E* and *G*, where they are not to be loosened at all; and at their other ends *F* and *H*, the shaft must be moveable, so as to be taken off, to let the two cross staves through two mortises in the beam *IK* of the plough; after which the shaft *CD* is put in its place, and fixed with two iron pins, *a, b*. Between the two shafts is placed the wheel *LM*, the nave of which is pierced through its center, with a hole proportioned to the thickness of the iron pin or spindle *NO*, which serves for an axle tree, and is represented by the two pricked lines. This spindle, or axle tree, the diameter of which is about three quarters of an inch, ought not to project beyond the outside of the shafts, lest it should lay hold of or hurt the stalks of the corn, when the plough is used. To fix it at *N*, that end is flattened, and bent over the shaft to the middle of its upper side, where it is fastened at *d*, by a small pin driven through it and the shaft.

On the upper surface of each of the shafts, at the ends *A* and *C*, are the hooks *AC*, to which the harness is fastened; and at the other ends *B* and *D*, are two rings, the use of which will be explained hereafter.

The

The shafts *AB*, *CD*, should be pierced with four or five holes, to set the wheel more or less forward or backward, in order to make the plough strike more or less deep into the earth, as may be seen in *fig. 1. a, b, c, d*. The same holes are indicated by the pricked lines on the two shafts of *fig. 2*, from *A* to *N*, and from *C* to *O*.

Of the Plough Tail.

THIS part consists of the beam *IK*, *fig. 1 & 2*; the ground-rest *CD* *fig. 1*, which is covered by the share *LD*; the handles *KP*, *KQ* *fig. 2*, and *KP* *fig. 1*, the sheat *EF* *fig. 1*, of which part is pricked in *fig. 1*, and the end appears at *X*, in *fig. 2*; the mould board *RS* *fig. 2*, part of which is seen at *N* in *fig. 1*; the coulter *GH* *fig. 1*, and *TV* *fig. 2*, and the share *LD* *fig. 1*, part of which is seen at *X* in *fig. 2*.

The beam is four feet eight inches long, exclusive of the tenon which traverses the handles. Three inches and a quarter square are very sufficient in its thickest part, which is from *X* to *K*, *fig. 2*. The mortises in the beam, which are under *g, b*, and through which the two cross staves *EF*, *GH*, are slipped, should be so fitted, that the cross staves may not shake or be loose in them, at the same time that the beam should, by their help, slip with ease over the cross staves, either to the right towards *EG*, or to the left towards *FH*, according as the intended plowing may require. The beam should be fastened, either by two nuts screwed on at *m n*, which will fix it tight to the cross staves *EF*, *GH*; or by two iron pins, stuck through the holes *p* and *q* in the two cross staves, one to the right in the cross staff *EF*, and the other to the left in the cross staff *GH*. These pins will keep the beam steady in its place.

The lower part of the ground-rest should be somewhat concave, as is represented at *CD*, *fig. 4, Pl. II.* in order to lessen its friction against the earth.

The beam *IK*, *fig. 1*, and the ground rest *CD*, are fastened together by the sheat *RE*, and the handles *PK*, *b*, both of which are riveted to the ground-rest by two strong iron pins, the heads of which are seen at *g* and *b*; and to the beam, as also the tenon of the beam which traverses the handles at *m, n*; and by the two wedges, *p, a* and *q*, another use of which will be explained hereafter.

Wood naturally crooked is best to make the handles of, that they may be all of one piece, which should be so disposed, that one third
of

of the space between the two handles, should be on the left side, and the two other thirds on the right side, in order to facilitate the plowman's walking in the furrow. This disposition is shewed in *fig. 2.* in which a line *r, f,* drawn from the middle of the beam, between the two handles, give to the left side a third *Pf* of the distance *PQ* between the two handles, and the two other thirds *fQ* to the other side.

For want of wood naturally bent to a proper shape, these handles may be made of two pieces firmly riveted and fastened together; and if it should be more convenient to the plowmen, the whole space between the handles may be on the right side, as in *fig. 6.*

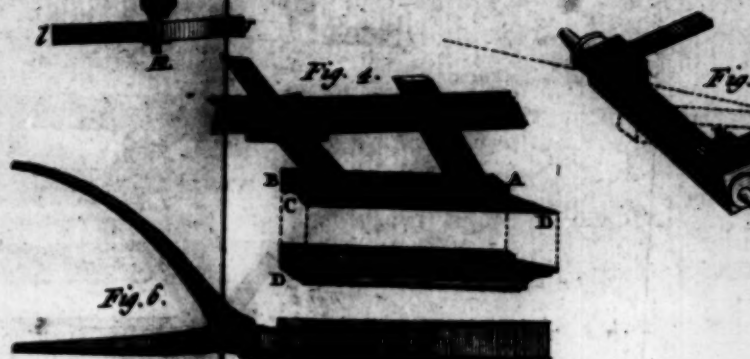
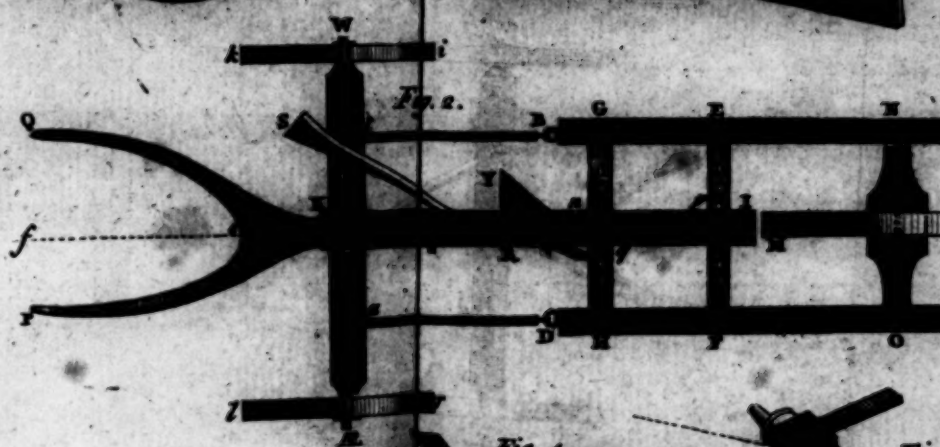
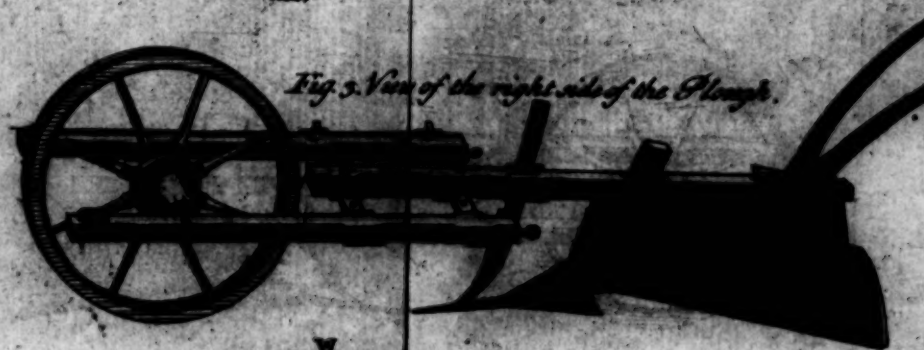
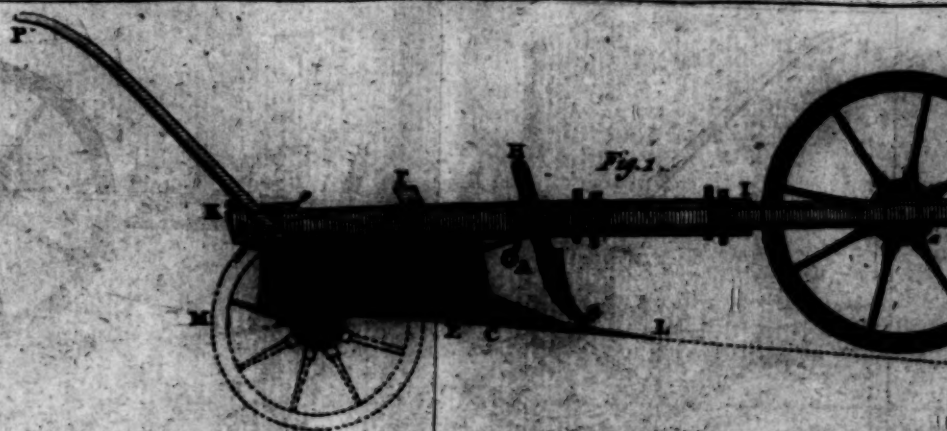
The sheat *EF* *fig. 1,* should be very strongly and closely fastened by its tenon to the ground-rest, at *g.* An intelligent workman will easily make it of a proper size, which is about two inches and a half wide, and a full inch thick. The inclining of this piece with the ground-rest, gives it greater strength to resist, than if it was fastened to it at right angles.

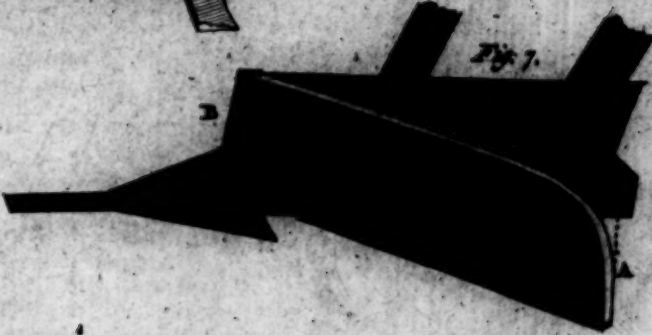
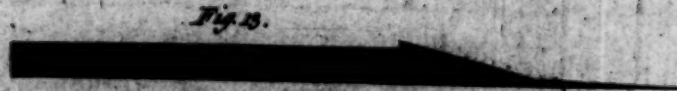
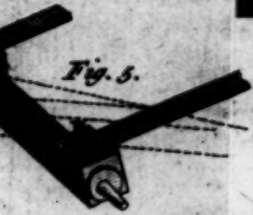
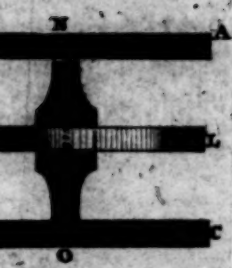
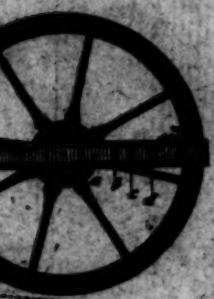
The mould-board, represented by *RS, fig. 2* and *AB, fig. 7,* is from 30 to 31 inches long, and ten inches high or deep. It ought to be placed as in *fig. 8,* where its end *A* forms an acute angle, terminating at the junction of the fin of the share: its other end *B* extends beyond the length of the ground-rest, against which it ought to incline, in such manner that, supposing the ground-rest to be lengthened out as far as *C,* the line *CB* would be twelve or thirteen inches long, reckoning from the farthest lateral surface of the ground-rest to the farthest lateral surface of the mould-board, which, being thus placed, will form the width of the furrow.

The lower part of this mould-board is sloped a little inwards, as is expressed by the shade in *fig. 7:* and the part *b* *fig. 7,* should jet out at least two inches beyond the part *a.* To this end, the mould-board should be made of a plank about three inches thick, which will bear scooping on both sides, in order to give it the concavity without, and the convexity within, represented in *fig. 3* and *7.*

The mould-board should be well fastened, to prevent its being displaced by the resistance of the earth. The upright piece *CD* *fig. 7,* which joins to the handles at its end *D,* and to the mould-board at its other end *C,* supports it strongly. It is highly necessary to cover the part of the mould-board which bears upon the earth, with a thin hoop of iron, in order to preserve it; for otherwise it would soon be worn out.

The





Scale of 6 Feet for Fig. 1 & 2.

Scale of 3 Feet for Fig. 3, 4, 5, 6, 7, 8.

The coultter *GH*, *fig. 1*, should be made of good iron well steel'd. A notch is cut in the beam to receive it, *fig. 9* and *10*; and as the corners of that notch, *C* and *B*, against which the coultter bears hardest when the plough works, would soon be worn away if the wood was left bare, it is proper to secure them with two small pieces of iron *AB*, *CD*, about the sixth part of an inch in thickness, screwed on with flat headed screws. These pieces of iron will keep the coultter steady in its place.

The coultter should be pierced with several holes, from *E* to *F*, *fig. 10*, to take it up higher, or let it lower down, as occasion may require. It is fastened to the beam, which is pierced at *E*, *fig. 9*, by a strong iron pin with a square flat head, which is let into the beam and lies even with it, as in *fig. 10*. The other end of this pin, *E*, *fig. 10*, is a screw, fitted with its nut, by which the coultter is fastened tight to the beam. Upon this screw hangs the handle *A*, *fig. 11*, which serves to turn it, and at the end of which is the key that fastens on the nuts of the iron pins which secure the share. By this means, the key to turn the screws is always carried with the plough.

M. de Chateau-vieux's coultters weigh but five or six pounds a piece at most, and frequently not more than three pounds.

He places his coultter so that its point *G*, *fig. 1*, jets out about an inch beyond the outside of the share *LG*.

Fig. 12 represents the plan of the share, with its dimensions, as do also *fig. 13* and *14*. The point should be made of good steel, and the rest of good iron, neither too soft, nor too highly temper'd, that it may not be subject to break or bend. The tail of the share, *AB*, *fig. 12*, should be thickest from *A* to *C*, because that is the part which bears the greatest stress. Its thickness diminishes gradually to *B*, where the share is fastened to the ground-rest. This tail is pierced with two round holes at *A* and *B*, *fig. 13*, through which are put the iron pins *DE*, *FG*, *fig. 12*, which have square flat heads, lying even with the tail of the share. These pins pass through the ground-rest, where they are fastened on the other side by the nuts *EG*. A third round hole may be added at *x* *fig. 13*, in order to fasten the share still more firmly to the ground-rest, with a short flat headed screw.

M. de Chateau-vieux has likewise made some ploughs with the round holes *a b*, *fig. 13*, near *A* and *B*, that the iron pins *DE*, *FG*, *fig. 12*, might not traverse the tenons of the sheat and handles; and

instead of those iron pins, he has riveted them with wooden pins; and found them keep the whole tighter together than the iron ones.

To the left side of the plough should be fastened the thin board *N*, *fig. 1 & 7*, the use of which is to prevent the earth from tumbling over between the share and the mould-board. Plowing wears the point of the share; but much less than it does that of our common ploughs. However, it must be new pointed from time to time, always observing to make the point incline a little towards the earth, as is represented by the pricked line *DL*, *fig. 1*; that the share may scarcely touch the ground at any other part than *D* and *L*, in order to lessen the friction.

The hind part of the plough, thus formed, is joined to the fore carriage, by running the cross staves *EF*, *GH*, *fig. 2*, through the mortises of the beam, *g* and *b*; and fixed them, either by the forewys *m*, *n*, or the pins *p*, *q*. The traces of the first and second horse are fastened to the hooks *AC*; and if a third horse is used, the traces of that third horse are fastened to those of the second. Horses will do better for this plough, than oxen, unless these last have been used to be harnessed one before the other.

The plough thus equipped, may easily be carried to the field, if its hind part is laid upon the little carriage *EW*, *fig. 2*, consisting of an iron axle tree *EW*, two small wheels *ki*, *lr*, and the two pieces *Bt*, *Dv*, at the end of which are the hooks *B* and *D*. These wheels are about 21 inches or two feet in diameter, and three feet six inches, or even four feet asunder. They are very light, having but a small weight to bear. The hooks of these two pieces *Bt*, *Dv*, are hooked to the rings *B* and *D*, at the end of the shafts; and by this means the plough will be carried upon three wheels, of which *fig. 1*, and *2* shew sufficiently the arrangement and use. *Fig. 3*, shews the slope that should be given the upper surface of the middle of the axle tree of this small carriage on which the rest of the plough is to be loaded in order to remove it from one place to another, that the ground-rest and other pieces may lie flat, and steady upon it.

M. de Chateau-vieux's directions for using this plough.

TO open the first furrow, the wheel must be placed at the last hole, towards the extremity of the shafts. This makes the share incline the more, and consequently cut the deeper. But as it would be somewhat troublesome to change the position of the wheel

at every first cut of the plough, a very little attention will remedy that inconvenience. It is only inclining the handles of the plough to the right or left, instead of holding them even. The whole plough will incline with the handles, and the share will then enter into the ground with ease, and open the first furrow. The other furrows are plowed without any sort of difficulty; and for them, the plough is to be held even, or inclined but very little, either to the right hand or the left, as the situation of the land may require.

M. de Chateau-vieux says he generally rests the beam on the left hand side of the fore-carriage. It is easy to place it so as to leave whatever distance is thought proper between the outmost row of corn and the furrow that is actually plowing.

The forwarder the wheel is set, the deeper the plough cuts: and so on the contrary. But if one would have it cut still deeper, or shallower, than it can be made to do by altering the position of the wheel; that too may easily be effected. By loosening a little the wedge above the beam, *p, o, fig. 1.* and driving farther in the wedge *q*, the plough will cut less deep: as, on the other hand, the share will be more inclined, and therefore cut deeper, if the wedge *q*, under the beam, is loosened, and the wedge *p, o*, over it, is driven in tighter.

S E C T. II.

Description of M. Duhamel's plough, used in the experiments at Denainvilliers.

THE chief difference between M. de Chateau-vieux's plough, and that of M. Duhamel, are as follow.

1. The beam of this last, *ACB*, Plate III. is bent from *C* to *B*; whereas that of M. de Chateau-vieux's is nearly strait all along.

2. In consequence of this curve, the hindmost extremity of M. Duhamel's beam, is joined at *B* to the hindermost part of the ground-rest *B*, after passing through a mortise *F*, in the lower part of the handles: so that this beam is joined to the ground-rest by its extremity *B*, the bottom of the handles *F*, and the sheat *G*; whilst that of M. de Chateau-vieux's plough, is joined to the ground-rest by this sheat, another which this plough has not, and the lower part of the handles: for the beam does not answer to the ground-rest.

3. The mould board *HI* of this plough, is lighter than that of M. de Chateau-vieux's, and differently shaped.

4. The two handles *KK*, are at equal distances from the beam, and are joined together by a cross staff *M*.

5. The share *N*, is pretty much like that of *M. de Chateau-vieux's* plough, but shorter and narrower, so that it cuts less wide furrows, which *M. Duhamel* thinks the best way of ploughing.

6. The coulter *O* of this plough passes through a mortise in the beam, which is strengthened in this place by hoops of iron, to prevent the beam's being split by the driving in of the wedges *PP* which fix the coulter.

M. Duhamel thinks this hind part of his plough preferable to that of *M. de Chateau-vieux's*, for light lands; but it would not do so well in stiff soils, because the earth would be apt to clog about the sheat at *Q*; whereas it is thrown off by *M. de Chateau-vieux's* plough. *M. Duhamel* likewise approves of making the beam strait, as *M. de Chateau-vieux's* is, instead of giving it the bending from *C* to *B*; especially for stiff lands.

7. The beam *CA*, is fixed to the cross-staves *RR* of the fore-carriage of this plough, by the screws and nuts *SS*.

8. The shafts *TT*, are fastened before by a cross staff *V*, which gives great solidity to the fore-carriage, and cannot be added to *M. de Chateau-vieux's* plough; not only because the wheel is too large, but likewise because it must be set forward or backward, in order to make the share cut more or less deep.

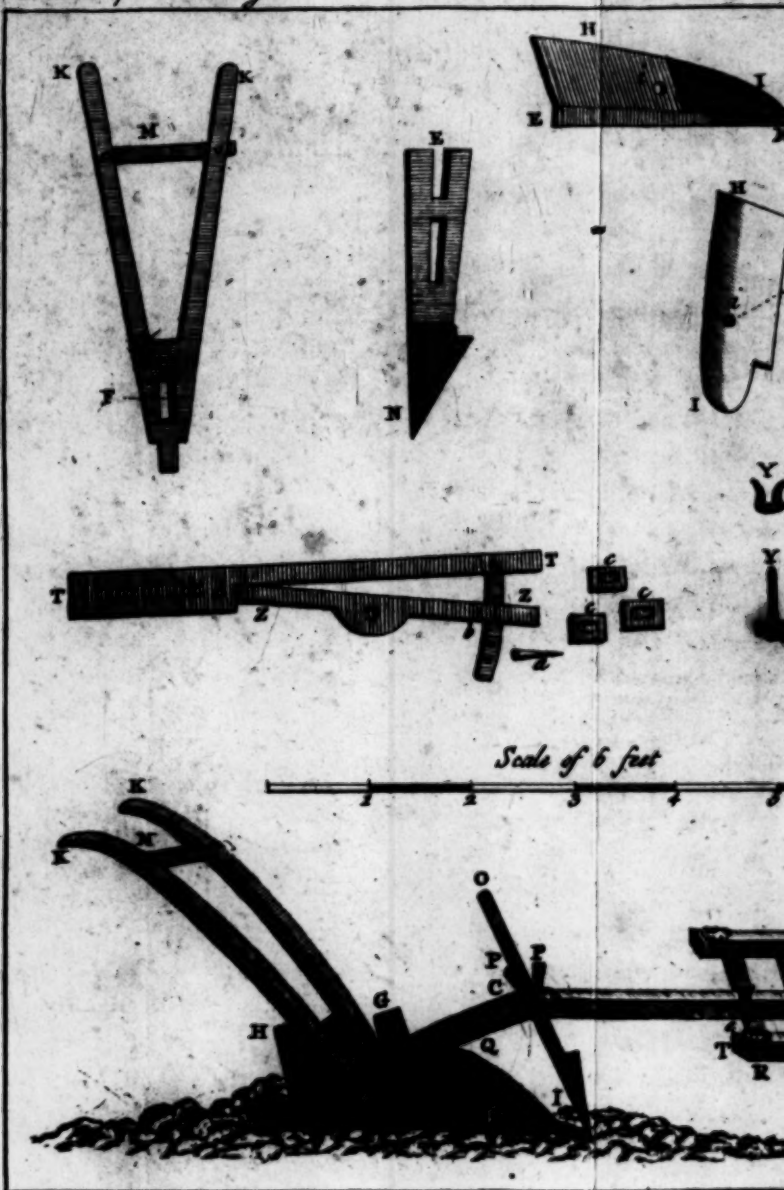
The wheel of this plough is not so large as that of *M. de Chateau-vieux's*, because the axle-tree, instead of being inserted in the shafts *TT*, is let into the side pieces *X*, which are fastened to the shaft by the screws and nuts *XX*.

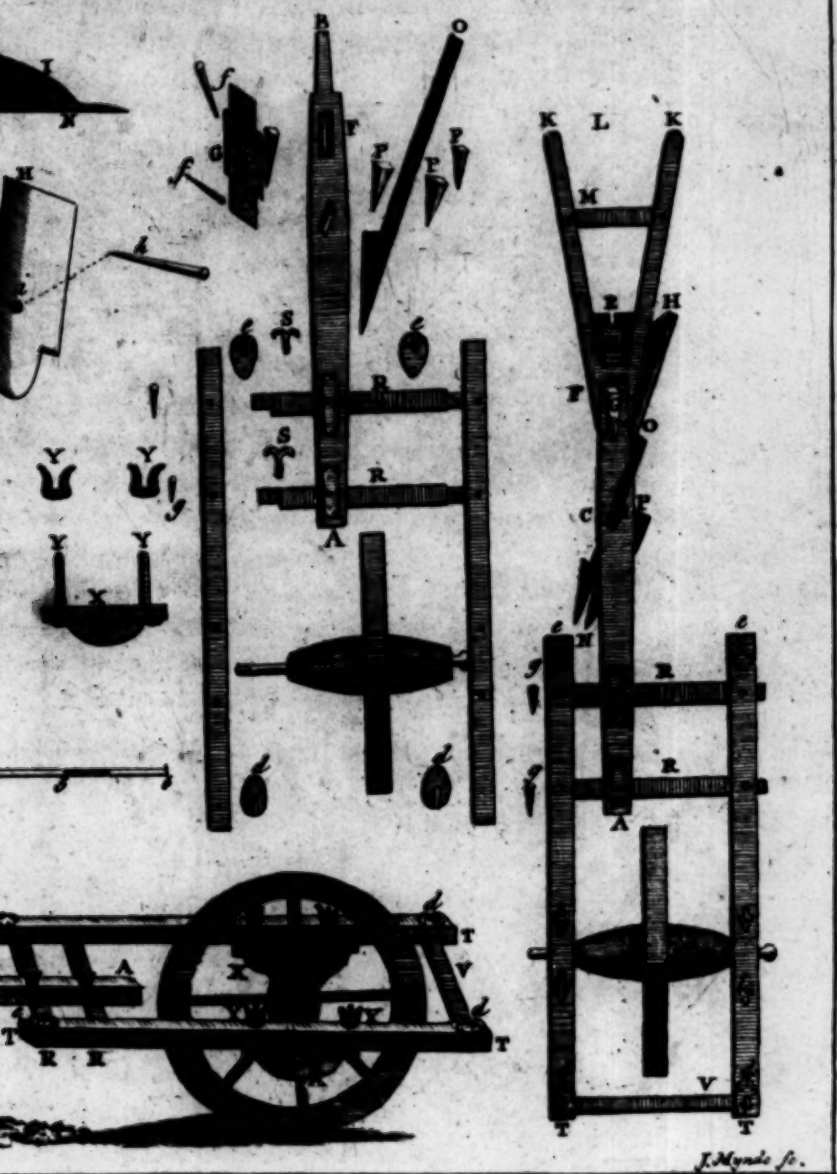
The advantages of having the wheel smaller, are, 1. That the plough is less apt to lean too much on its side, and is more easily held upright; 2. That the cross staff *V* may be added to the fore-carriage, by which it is rendered more solid; and 3. That the fore-carriage may be made shorter than it could otherwise be.

The bare inspection of the draught of this plough, shews that it is made to cut more or less deep, by screwing the nuts *Y* more or less tight, and putting a thicker or thinner wedge between the side piece *X* and the shaft; which is an easier and quicker way, than changing the situation of the wheel. But a readier method still, is, to have under the shafts *TT*, a false shaft *ZZ*, fixed with hinges at *Q*: for then, by only sticking the peg *a*, into one of the holes *b*, the beam is raised or lower'd, in a moment, to whatever degree is thought proper, without altering the position of the wheel.

It

Treatise of Husbandry.





It is likewise evident, that in order to give the share a greater or less degree of entrance into the earth, nothing more is requisite than to place the beam nearer to, or farther from, the right hand shaft: for the horses, which are harnessed one before another, go, as does also the wheel, in the last made furrow, and the plowman goes in the furrow actually making.

d. d. Hooks to fasten on the harnesses of the horses.

e. e. Cramps to fasten the fore-carriage.

f. f. Pins to fasten the beam to the sheat.

g. g. Pegs to fasten the cross staves.

b. A strong pin which goes through the hole *i*, to keep the mould board steady.

CHAP. II.

OF DRILL-PLOUGHS.

SECT. I.

Of Mr. Worlidge's Drill-Plough.

THE two first inventions of this kind were Mr. Worlidge's drill-plough, and Don Joseph de Lucatello's Sembrador; both of which may claim the merit of being originals. As neither Mr. Tull, nor M. Duhamel, have taken any notice of this instrument of Mr. Worlidge, which we are persuaded will fully answer all the ends he proposes, we think it a justice due to one of the best writers on agriculture, to give his own account of it.

"Besides the usual manner of sowing corn, there are," says he, "several other ways of dispersing it, as by setting, and hoeing of it in, &c. This art of setting corn seems to be very ancient, as appears by Virgil, *Unguibus infodiunt & ipsis fruges* — and hath been a long time attempted to be brought into practice again, as appears by Mr. Platt's *Adam's Tool Revived*". Mr. Worlidge then points out the defects in Mr. Platt's instruments, and proceeds thus.

"But to remedy and remove all manner of errors and inconveniences that can be found in setting of corn, I shall here give you a plain and perfect description of an easy and feasible instrument, that shall disperse your corn, grain, or pulse, of what kind soever, at what distance, and in what proportion you please to design,

and

“ and that with very great expedition, and very little extraordinary charge, expence, or hazard.

“ First, make a frame of timber, of about two or three inches square, the breadth of the frame about two foot, the height about eighteen inches, the length about four foot, more or less as you please, as at *uuuu*, *fig. 1. Plate IV.* Place this frame on two pair of ordinary wheels, like plough-wheels. The axle-tree of the two foremost wheels is to lock on either side, as doth the fore axle-tree of a waggon, for reasons hereafter shewn. The hindermost axle-tree, being of iron, and square in the middle, must be fixed to the center of the wheels, that the axis and wheels may move together: then, about the middle of the frame, in the bottom, let there be fixed an iron instrument, or of wood pointed with iron, like unto a coulter, made a little spreading at the bottom, in the nature of a share, made to pass through two mortises on the top for its greater strength; and made also to be wedged higher or lower, according as you will have your furrow in depth, as at *oo*; the use whereof is only to make the furrow: so that you must make the point thereof of breadth only to move the earth, and cast it, or force it, on either side, that the corn may fall to the bottom of the furrow. Then, over this share, or coulter, a little behind it, may a wooden pipe be made, to come from the top of the frame to the lower end of the share, tapering downward, as at *p*, and as near as you can to the share: to deliver the corn immediately, as the ground is opened, and before any earth falls in; that what earth does afterwards fall in, may fall on the corn. This pipe is to proceed out of a large hopper fixed on the top of the frame, that may contain about a bushel, as at *q*: but so that the corn may gradually descend, according to the quantity you intend to bestow on an acre. At the very neck of the hopper, underneath, in a square hollow thereof, must be fitted in the edge of a wheel of wood, about half an inch thick, and proportioned to the cavity of the neck, as behind the letter *r*. The wheel need not be above two or inches diameter, and fixed on an axis extending from one side of the frame, to the other: on which axis is also to be another wheel, with an edge on the circumference thereof, like the wheel of a spit or jack, as at *r*, which must answer to another wheel of the like nature and form, fixed on the axis of the hindermost of the wheels, as at *s*: then fit a line, (of silk is best,) because
“ it

it will not be so apt to shrink and reach as hemp) " about these
 " two wheels, that when the instrument moves on the hindmost
 " wheels, by means of the line, the small wheel, at the neck of
 " the hopper, may also move; which lesser wheel in the neck of
 " the hopper, may have short pieces of thick leather fixed in the
 " circumference thereof, like unto the teeth of a jack-wheel, that
 " upon its motion it may deduce the corn out of the hopper, in
 " what proportion you please; for in case it comes too fast, then
 " you may by a wedge at the tenon of the piece whereon the hopper
 " rests, as at *s*, or at the end of the axis of the lesser wheel, force
 " the wheel and hopper together; as in case it feeds too slow, then
 " may you remove them by the same wedges to a farther distance:
 " also in case your line be too slack or too hard, you may prevent
 " either extreame by a wedge in the place where the axis of the
 " wheel moves, or by a third wheel, about the middle of the line,
 " made to move farther or nearer, as you see cause.

" Also by means of the iron rod *uv*, fixed to the foremost axis
 " that is made to lock, may you guide your engine at pleasure;
 " which rod is made crooked at the end of the hopper, lest that
 " should injure its motion.

" And at the turning, you may lift up your engine by the handles
 " at *x*: for whilst you lift it up, the corn feeds not until you set
 " the same down again.

" One horse and one man may work with this instrument, and
 " sow land as fast or faster than six horses can plow; so that you
 " may with ease compute the expence, in case your instrument be
 " single: but you may in the same frame have two shares at twelve
 " inches distance, more or less, as you will have the rows of corn
 " distant the one from the other; and two pipes out of the same
 " hopper, and two small wheels on the same axis, with other wheels
 " answerable, every whit as easy to be performed as one; and then
 " you may double your proportion of land in a day.

" This instrument will always keep the same proportion you first
 " set it too, which you must thus contrive. First, know the length
 " of the furrow you sow: then cast up how many of these furrows
 " at such a distance your instrument is made for (whether a foot,
 " more or less,) will amount to an acre: then conclude how much
 " to sow on an acre; as suppose a bushel: then divide that bushel
 " into so many parts as you have furrows or distances in that acre:
 " then take one or two of those parts, and put it into your hopper,
 " and

“ and observe whether it will hold out, or superabound at the end
 “ of one or two furrows, and accordingly proceed and rectify the
 “ feeder: or you may judge by your own reason, whether it feed
 “ too fast or too slow.

“ In case it feeds too fast, notwithstanding they be close placed
 “ together, you may make that wheel at the lower axis, wherein
 “ the line moves, to be less than the upper; then will the motion
 “ be slower: and thus may you make it move as slow as you will,
 “ by augmenting the upper, and diminishing the lower wheels
 “ wherein the line is; and make it move faster by the contrary rule.

“ In case you drive apace, it feeds apace: in case you drive but
 “ slow, it feeds but slowly: here is no error.

“ When you come to any turning at the lands end, by lifting up
 “ the hindermost part of the instrument, that those wheels touch
 “ not the ground, the feeding of the corn immediately ceaseth until
 “ you set it down again.

“ Also all the corn you sow lies at a certain depth, none too
 “ deep, nor any too shallow.

“ You may place a kind of harrow to follow; but the best way
 “ is to have on each side each furrow, a piece of wood, a little
 “ broad at the end, set aslope to force the earth rounding on the
 “ corn. This may be well placed and fitted to the bottom of this
 “ instrument, just behind the share and feeding pipe.

“ By this method of sowing any sort of grain or pulse, may be
 “ saved the one half, and in some places more, which by the other
 “ way is either buried so deep under clots, that it cannot come up,
 “ or else is so shallow, that the cold in the winter, or drought in
 “ the summer killeth it, or else lies on the surface as a prey to the
 “ fowls of the air: much also thereof falls in clusters, twenty or
 “ thirty grains where one or two might suffice, which are common
 “ inconveniencies, and usually happening to the vulgar way of sow-
 “ ing corn: the greater half by far is lost, which in all probability
 “ may be saved by the use of this very instrument, which will
 “ doubly requite the extraordinary charge and trouble thereof:
 “ for here is no corn sowed under clots, but in rows, as the earth
 “ is stirred and moved: it is all at one certain depth and at one
 “ certain distance, and equally covered, below the injury of frost,
 “ and heat, and rapine of birds. Also by this way corn may be
 “ sown in the very middle or convenient depth of the mould, that
 “ it may have the strength of the land both below and above the
 “ root:

“root: whilst in the other more usual way, the corn falls to the
 “bottom of the furrow on the gravel, clay, or such like hard ground,
 “where it seldom thrives so well as what happens to be in the
 “midst. This way also exceeds the way of *setting corn*, where the
 “pins thrust into the ground, harden and fasten the mould, so that
 “unless the land be very light, it confines the roots to too narrow
 “a place, which in this way is prevented; as I have observed in
 “garden beans, that those hoed in, proved better than those set
 “with a stick.

“By the use of this instrument also may you cover your grain
 “or pulse with any rich compost you shall prepare for that pur-
 “pose, either with pigeon dung dry or granulated, or any other
 “saline or fixivial substance, made dispersible, which may drop
 “after the corn, and prove an excellent improvement: for we find
 “experimentally, that pigeon’s dung sown by the hand on wheat
 “or barley, mightily advantageth it by the common way of hus-
 “bandry: much more then might we expect this way, where the
 “dung, or such like substance is all in the same furrow with the
 “corn; whereas in the other vulgar way, a great part thereof comes
 “not near it.

“It may either be done by having another hopper on the same
 “frame behind that for the corn, wherein the compost may be
 “put, and made to drop successively after the corn: or it may be
 “sown by another instrument to follow the former, which is the
 “better way, and may both disperse the soil, and cover both soil
 “and seed.

“The corn also thus sown in ranges, you may with much more
 “conveniency go between, and either weed it or hoe it, and earth
 “it up as you think good, and at harvest it will easily repay the
 “charges.

“Also the fore-wheels being made to lock to and fro on either
 “side, you may have an upright iron pin fixed to the middle of the
 “axis, extended to the top of the frame: and from thence a small
 “rod of iron to come to your hand, with a crooked neck just against
 “the neck of the hopper; by means of which iron rod, you may
 “lock or turn the wheels either way, and guide your instrument,
 “and rectify it, if it deviate out of its right course.

“The hopper must be broad and shallow, that the seed press
 “not much harder when it is full, than when it is near empty,
 “lest it sow not proportionably.

K k k

“ This

"This instrument, although it may at the first seem mysterious and intricate to the ignorant, yet I am confident it will answer to every particular of what I have written of it; and any ingenious wheel-wright, joyner, or carpenter, may easily make the same with very little instruction, and any ordinary ploughman may use it."

S E C T. II.

Of the Sembrador.

IN the account given of this instrument, in the Philosophical Transactions, N^o. 60. it is justly observed, that the perfection of agriculture consists in setting the plants at proportionable distances, and giving sufficient depth to the roots, that they may spread to receive that nourishment from the ground, which is necessary to produce and ripen the fruit: but this has been so far from being observed, that all sorts of seeds are sown by handfuls at random; whence it happens, that corn in some places is sowed too thick, in others too thin, and the greater part of it either not covered, or not deep enough: whereby, it is not only exposed to be eaten by birds, but also in cold countries to be spoiled by frost, and in hot climates, by the sun. On these considerations, Don Joseph de Lucatello invented an instrument, which, being fastened to the plough, at once plows, sows and harrows; whereby the sower's labour is saved, and the grain, falling in order, and in the bottom of the furrow, remains at the same distance under ground; so that in five parts of seed, four are saved, and the increase becomes very considerable.

The following is the description of this instrument.

"Fig. 2. Plate IV. is a box of wood: *a b c d*, the cover of that part into which the corn is put, which is open in *fig. 3*, at *W*: *e f b g k l*, the two sides that cover that part of the box where the cylinder, which is stuck round with three rows of little spoons, is moved about to throw out the grains; which sides are taken off in *fig. 3*, that the cylinder *R S*, and the spoons *x x x* may appear. The internal shape of these sides is expressed in *fig. 4*, where may be seen the four triangular pieces *p p p p*, and the triangular interstices *q q q*, which serve to convey the corn, carried up in the spoons, and discharged at the top of the cylinder, to run out of the holes underneath the box.

"*T*, is one of the wheels: *V*, the other end of the cylinder, on which the other wheel is to be fixed.

"This

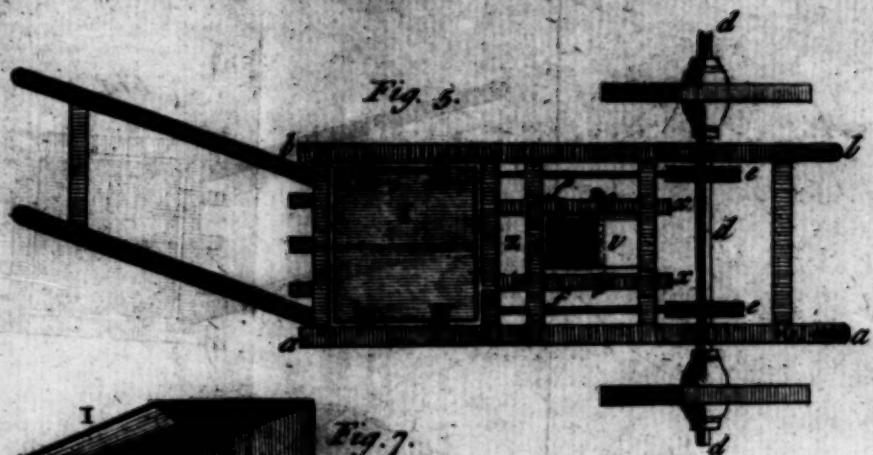
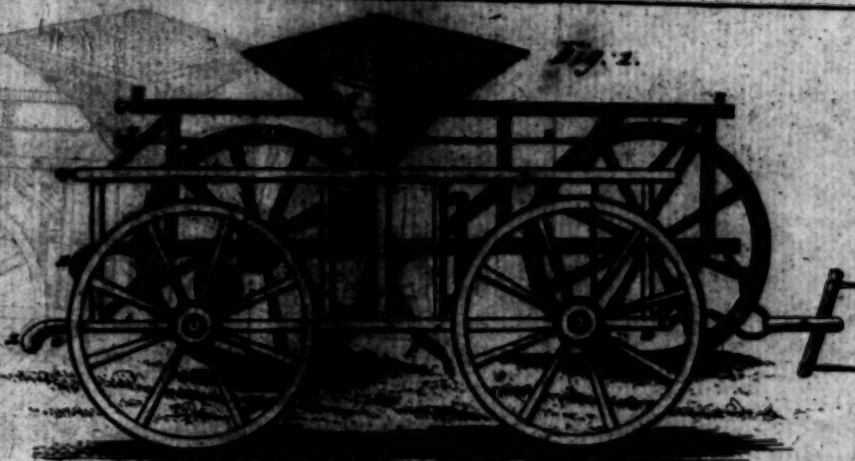


Fig. 2.

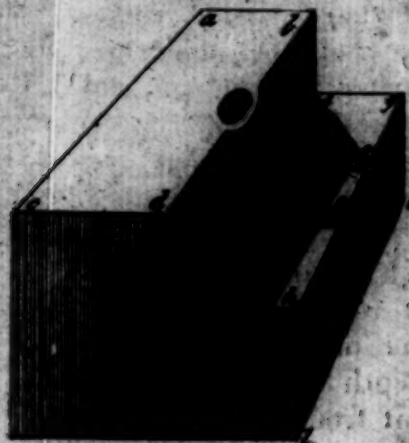


Fig. 3.



Fig. 6.

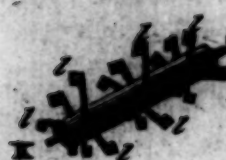


Fig. 4.

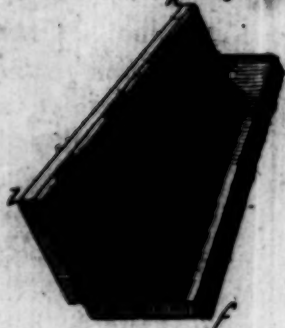


Fig. 11.



Fig. 10.



Fig. 9.

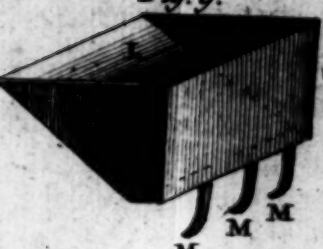
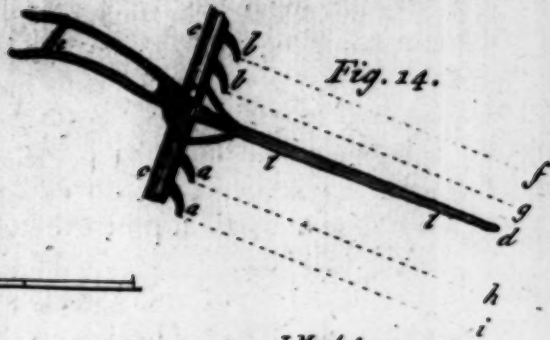


Fig. 14.



J. Myndt sc.

This *fembrador*, or box, is, according to Don Lucatello's method, to be tied fast to the hind part of the plough, so that the corn may fall in the furrow, and at the turning of the plough, its ears may cover the corn of the last furrow with earth. Care must be taken that the wheels on the sides of this instrument do always turn round, and never drag along without turning: to which end, it must be fastened to the plough-beam, at such a height that the nails in the wheels may stand on the ground, to make them turn round. The ears of the plough used on this occasion must also be made larger than ordinary, that they may cover the furrows better, when sown, and make wider furrows to receive the seed.

Both these instruments have their imperfections. The manner in which the wheels, and consequently the cylinder of the *fembrador* are turned, must occasion an unequal distribution of the seed, wherever the ground is rough or stoney: and in Mr. Worlidge's drill, the seed is liable to be bruised as it drops from the hopper, by the wheel in the neck of that hopper.

We apprehend that a more useful instrument may be formed out of these two, than either of them is as they now stand: viz. by fixing the box of the *fembrador*, in the frame of Mr. Worlidge's drill. A square frame, like that, will keep the box more steady, and therefore render the discharge of the seed more regular, than it can be either in Don Lucatello's manner, or in a single frame, as proposed by M. Diancourt, in an instrument formed on these principles, and of which M. Duhamel gives the following description.

On the outside of the shafts *aa*, *bb*, (Plate IV. fig. 5.) are two wheels. Their axle-tree *ddd* turns round with them.

On this axle-tree are two pullies *ee*, which receive into their grove two lines *ff*, which turn the cylinder *Gg*, fig. 6 and 7. This cylinder has three rows of spoons fixed on it, and goes through the hollows *zzzz* (fig. 8.) of the half barrel *Hb*, fig. 7 and 8. This half barrel is placed sloping in the box *I, I*, fig. 7 and 5, as is represented at the bottom of that box, at *b*, fig. 7.

The box *I* is represented with its cover on in fig. 5. In fig. 7. one of the ends is taken off, to shew at *b* the end of the half barrel *g*; one of the ends of the cylinder *K*, and some of the spoons *l*, fig. 6; with an inclined plane *L*, which forms a hopper, into which the seed is put, and from whence it drops to the bottom of the barrel *b*, fig. 7. through the pipes *MMM*, fig. 9; and *mmm*, fig. 7.

K k k 2

These

These pipes are bent to the shape of the inside of the half barrel, *fig. 8* in which they are fixed so as not to interrupt the motion of the spoons, *fig. 7*; and they extend to the bottom of the barrel in such manner that, reaching the ground, they give out the seed only in proportion to what is taken up by the spoons. The direction of these pipes is not exactly represented in *fig. 7*, because they do not there terminate, in the barrel *B*. That part of the drawing is intended only to give an idea of their position.

The spoons throw the seed over at *n*, *fig. 9*, where it falls into the divisions *p q r*, *fig. 10*, which are fastened to the shaft *s a*, *fig. 5*, underneath the box *L*, and drops through the pipes *p p*, *fig. 10*, which terminate behind the shares *q*, *fig. 11*, passing through the opening *o*. The shares, *fig. 11*, terminate in a triangle at their bottom *t*, forming an angle forward, and a hollow behind. They are fastened by the screw *r*.

Besides this, M. Duhamel has placed at *v*, *fig. 5*, a small roller, which is likewise represented by *K*, *fig. 12*. This roller, which is about six inches diameter, is fastened to the shaft *s a*, *fig. 5*, by the two upright irons *y y*, *fig. 12*, by which the roller is placed higher or lower, according as the seed is intended to be sown more or less deep; and lastly, he has fixed to the cross shaft *x*, *fig. 5*, a kind of scraper, *fig. 13*, which clears the roller when it is clogged with earth.

Two pulleys, one on each side, are perhaps preferable to the single wheel which Mr. Worlidge has fixed on his hind axle-tree. The quantity of seed to be sown, may be regulated by the size of the pulleys, or wheels on the axle-tree; for the larger the pulleys are, the more frequently the cylinder on which the spoons are fixed, will be turned round, and the spoons will consequently deliver the greater quantity of seed. The size of the spoons may likewise be adapted to the size of the seed intended to be sown.

SECT. III.

Description of Mr. Vandusfel's Rake.

M. Duhamel, and several other gentlemen who have practised the new husbandry abroad, met with so many difficulties and inconveniences in the use of Mr. Tull's drill-plough, that they were obliged to contrive other methods of drilling their corn. One of the simplest inventions to answer this end, was M. Vandusfel's rake, of which

which M. Duhamel gives the following description, which we shall copy here for the benefit of such as have not a proper drill-plough; especially as this instrument may do very well, where the soil is light, and the extent of land intended to be sown is not large. It is, as in Plate IV. fig. 14, a strong kind of rake *cc*, with four great teeth *aa*, *bb*. The distance from *a* to *a*, and from *b* to *b*, is nine inches. M. Vandusfel makes it a foot, because, after his corn is sown, he buries it by drawing a cultivator with two mould boards between the rows.

The distance between the two inner teeth *a* and *b*, is three feet and a half, which is the width of the alleys.

To the head of this rake *cc*, are fixed the handles *e*, and the pole *d*, which answers to the beam of a plough.

As this instrument is drawn over ground in fine tilth, and a man presses more or less on the handles *e*, it forms four small furrows *fg*, *h*, so that the furrows *i* and *b* are nine inches asunder, and the furrows *g* and *f* the same, and a space of three feet and a half is left between *b* and *g*, for the width of the alley *hi*. In order to preserve the alleys always of the same width, M. Vandusfel draws the teeth *a* in the furrows before made by the teeth *bb*, so that the four furrows are made the first time this rake is drawn, only two are made each time after.

Great care must be taken to make the first furrows very strait, because the direction of all the others depends on them.

Women or children drop the seed by hand into these furrows, where it is afterwards covered with a harrow, or, as M. Vandusfel has done, with a cultivator with two mould boards, drawn between the two rows, as fast as they are sown. If any part chanceth not to be covered perfectly by this cultivator, it is easily done afterwards with a common rake.

SECT. IV.

Description of M. Duhamel's Drill-Plough.

M. Duhamel observes, that though M. de Chateau-vieux's drill delivers the grain with the greatest exactness, and therefore deserves much commendation; yet the price of it is too great for most farmers. M. Duhamel's, which we are going to describe, has, for that reason, been the most generally used. We could wish that the limits prescribed to this work would permit us to give also a full

full description of M. de Chateau-vieux's drill-plough; though we fear it would be too complex to be understood or made by common workmen, and, we doubt, too nice in many of its parts for the rough hands of common plowmen. We hope, however, that the ingenious and curious among our countrymen will not, on account of this our omission, be any ways induced not to consult the original in M. Duhamel's work, or not to endeavour to execute what has been so well contrived by one of the greatest geniuses in agriculture that this age can boast of.

M. Duhamel's drill is fixed to the fore carriage of a common plough. The make of that fore carriage is so well known, that it needs no particular description.

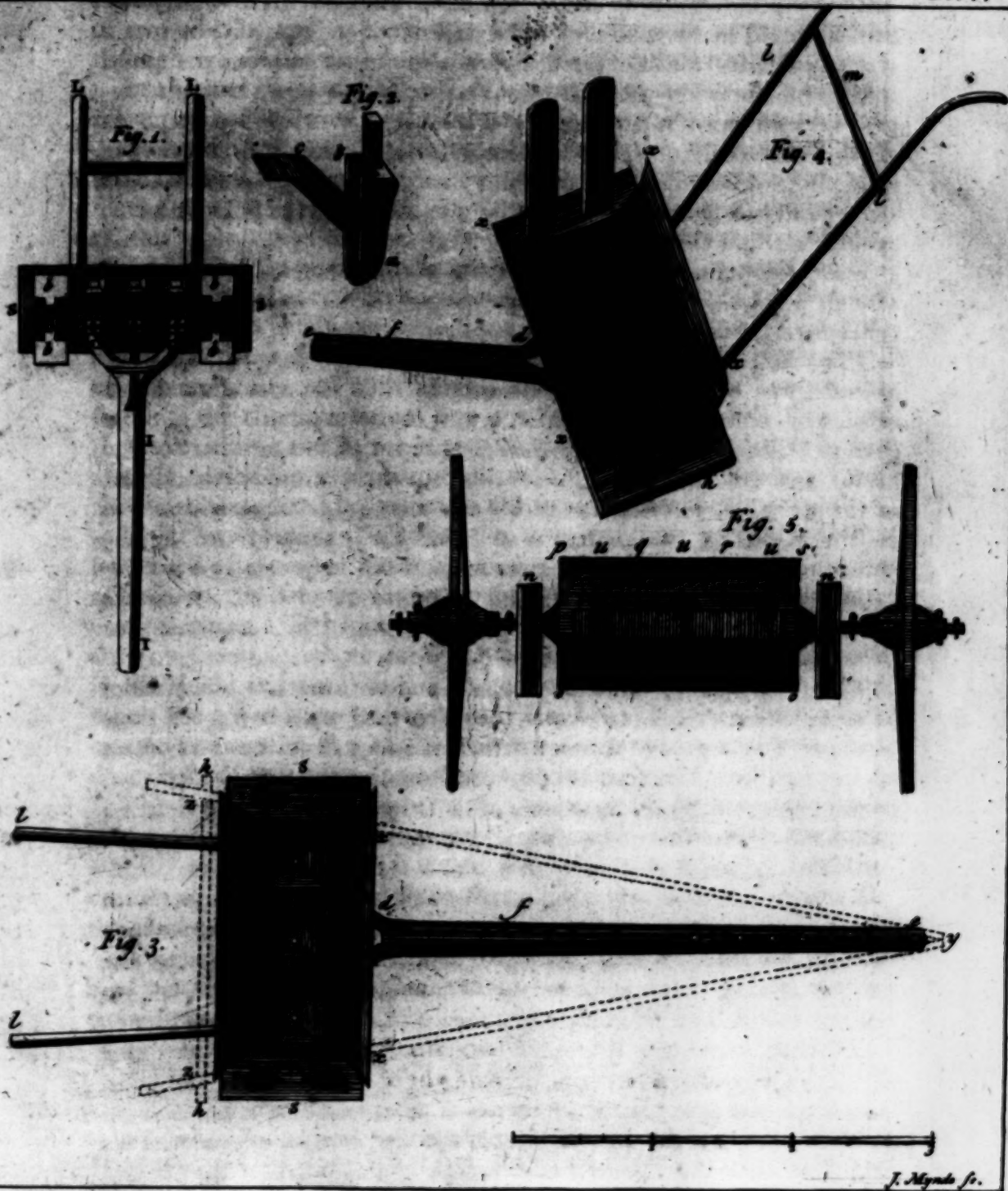
The hind part of this drill consists of a plank *S*, *S*, *fig. 1. Plate V.* at least three inches thick, which is called the table. Underneath this table, and to the bottom part of it, are strongly fixed, as at *TTY*, three shares. The beam, or pole, *I, I*, is fastened to the fore part of the table: and the handles *L, L*, are let into mortises in the back part of the table, in which they are fixed. *a, a, a*, are three cavities cut in the table, to receive the seed from the cylinder, and convey it through an opening in the center of each of them, into the hollow *c*, at the back of the share *fig. 2*. The form of these cavities is more clearly expressed by *a, c, b*, *fig. 3*. At *b, b, b, b*, are fixed four strong standards, to hold the drill-box steady.

The shares, *fig. 2*, are made of wood and terminate at the bottom of their fore part *a* in a circular form, covered with iron. In their hind part *b* is a groove through which the seed drops to the bottom of the furrow. The seed is conveyed from the cavities *a, c, b*, *fig. 3*, to this groove *b*, *fig. 4*, by means of a thin plate of iron, rounded and fixed to the share, as at *d*. These shares are about an inch and a half thick, and their height from *a* to *b* at least a foot.

As these shares terminate in a curve at bottom, if they meet with any roots, dung not thoroughly rotted, or any other substance which they cannot easily divide, they force it down to the bottom of the furrow, and by that means are never liable to be choaked: and to prevent this still more effectually, the middle share is placed somewhat more backward than the two others. It is likewise made shorter in proportion to the greater height of the middle of the beds. The shares are generally seven inches asunder.

M. Duhamel took the first hint of the seed box he now uses, from an invention of Mr. Grenville, then one of the pages of the king of

France's



The following is a list of the names of the persons who have been
 named in the above report, in the order in which they were
 named:

1. J. H. Smith	2. J. H. Smith	3. J. H. Smith	4. J. H. Smith
5. J. H. Smith	6. J. H. Smith	7. J. H. Smith	8. J. H. Smith
9. J. H. Smith	10. J. H. Smith	11. J. H. Smith	12. J. H. Smith
13. J. H. Smith	14. J. H. Smith	15. J. H. Smith	16. J. H. Smith
17. J. H. Smith	18. J. H. Smith	19. J. H. Smith	20. J. H. Smith
21. J. H. Smith	22. J. H. Smith	23. J. H. Smith	24. J. H. Smith
25. J. H. Smith	26. J. H. Smith	27. J. H. Smith	28. J. H. Smith
29. J. H. Smith	30. J. H. Smith	31. J. H. Smith	32. J. H. Smith
33. J. H. Smith	34. J. H. Smith	35. J. H. Smith	36. J. H. Smith
37. J. H. Smith	38. J. H. Smith	39. J. H. Smith	40. J. H. Smith
41. J. H. Smith	42. J. H. Smith	43. J. H. Smith	44. J. H. Smith
45. J. H. Smith	46. J. H. Smith	47. J. H. Smith	48. J. H. Smith
49. J. H. Smith	50. J. H. Smith	51. J. H. Smith	52. J. H. Smith
53. J. H. Smith	54. J. H. Smith	55. J. H. Smith	56. J. H. Smith
57. J. H. Smith	58. J. H. Smith	59. J. H. Smith	60. J. H. Smith
61. J. H. Smith	62. J. H. Smith	63. J. H. Smith	64. J. H. Smith
65. J. H. Smith	66. J. H. Smith	67. J. H. Smith	68. J. H. Smith
69. J. H. Smith	70. J. H. Smith	71. J. H. Smith	72. J. H. Smith
73. J. H. Smith	74. J. H. Smith	75. J. H. Smith	76. J. H. Smith
77. J. H. Smith	78. J. H. Smith	79. J. H. Smith	80. J. H. Smith
81. J. H. Smith	82. J. H. Smith	83. J. H. Smith	84. J. H. Smith
85. J. H. Smith	86. J. H. Smith	87. J. H. Smith	88. J. H. Smith
89. J. H. Smith	90. J. H. Smith	91. J. H. Smith	92. J. H. Smith
93. J. H. Smith	94. J. H. Smith	95. J. H. Smith	96. J. H. Smith
97. J. H. Smith	98. J. H. Smith	99. J. H. Smith	100. J. H. Smith

France's stables. This was a hollow ball, fixed upon the axle-tree of two wheels, and pierced round the middle with a row of holes, through which the seed dropt, as the wheels turned round*.

In the middle of the table *S, S*, are cut three cavities *a, c, b*, sloping on each side down to the center, where a hole of about an inch diameter lets the seed drop into the hollow plate *c*, *fig. 2*. The four standards *i, i, i, i*, *fig. 3* and *4*, are placed in such manner that the blocks *n, n*, *fig. 5*, in which a groove is cut, answer to the middle of this table. On an iron axle-tree which answers to the wheels, and which passes through the center of the blocks, is fixed the cylinder, or barrel *o, o*, which is closed at its ends, *p, s*, and is likewise divided by two partitions *q, r*. This barrel is made of thin split deal, as are also the ends and partitions. *t, t*, is a thin board, or plate of tin, or thin iron, fastened with hinges, that it may be opened to put the seed into the three partitions *p q, q r, r s*. In the middle of each of these partitions, the barrel is pierced with holes three or four inches asunder, and about a quarter of an inch in diameter. The barrel and the wheels are fixed on an iron axle-tree, so that all turn together.

To know whether the holes *u, u, u*, in the three partitions of the barrel are of a proper size and number to distribute the seed in the manner that is desired, let some, suppose half a bushel, be put into each partition. The blocks *n, n*, being placed on each side between the two standards, whose inner sides are rounded so as to fit the groove in the blocks and the table *S S*, being raised so that the wheels do not touch the ground, any one may easily see, by giving the wheels a turn or two round with the hand, whether the proper quantity of seed drops behind the share; and alter it accordingly.

The barrel being properly fitted, the beam is fastened to the fore-carriage of this drill. As it moves, the barrel turns with the hind wheels, and the seed drops out of the holes *u, u, u*, *fig. 5*. into the cavities *a, c, b*, *fig. 3*, and from thence into the hollow *c*, *fig. 2*. in the hind part of the share.

When the plowman comes to the end of the field, he lifts up the hind carriage, which is light, and carries it to the next bed that is to be sown.

* We apprehend that farmers who sow under furrow, might easily contrive to fix such a ball to the handles or hind part of their plough; and that it may be made to turn round, and so drop the seed, by means of small wheels, or by little eminences on its surface. The seed may be covered by the next turn of the plough, as usual. This method will save a great deal of seed, and yet the field may be sowed so that the corn shall grow as thick as the ground can bear.

M. Duhamel does not fix the diameter of the hind wheels, but leaves that to be determined by the length of the shares. His were so proportioned, that when the shares touched the ground, the wheels did not touch it by two inches. He observes, that this drill answered extremely well, where the ground was plowed into an even or level surface; but that the wheels were too small when the middle of the beds were raised; because the shares were then on the higher part of the bed, while the wheels were in the furrows.

In *fig. 3* and *4*, are two thin boards *x, x*, somewhat bending, which rise up to about half the height of the barrel. The use of these is to catch the seeds that may chance to drop from the oblique holes, and guide them into the cavities *a, c, b*.

It is well known, that when the fore part of the share terminates in a point, it pierces the deeper into the earth, the farther back the beam is placed on the fore-carriage: but as the bottom of our shares is round, they pierce neither more nor less when the beam is placed more forward. It is therefore advisable to place the fore and hind carriage as near as possible to one another, because the plough then goes easier, and the draught is lighter to the cattle.

This instrument is easily transported from place to place by means of two poles, *y, z, z*, *fig. 3*. The ends *y* are placed on the fore-carriage together with the beam, and from thence pass under the table, so as to raise the whole from the ground, on which their other ends *z, z*, rest. The cross bar *k, k*, secures those ends, and keeps them at a proper distance.

In the construction of the above instrument, as given by M. Duhamel, the shares must always pierce to the same depth, because the whole weight of the hind part of the drill rests continually upon them; consequently, it would be necessary to have shares of as many different lengths, as there are depths at which each kind of seed should be sowed.

We apprehend, that when the shares have pierced to the depth intended, the weight of the drill may be made to rest on the wheels, by preventing the axle tree from rising between the standards, beyond such a height as shall exactly regulate the depth to which the shares are to pierce. This may be effected, by bringing the standards *i, i*, *fig. 4*, nearer to each other; and placing between them, instead of the blocks *n, n*, *fig. 5*. two thick pieces of wood, made to slide up and down, with grooves, as in the blocks. These pieces of wood may be fixed between the standards, by means of two strong iron pins

pins run through the standards into them: and to take off the friction of the axle tree against these pieces of wood, it may be made to turn on two friction wheels, placed in the lower part of them; or rather on four or six small iron rollers turning on their axes* in a box inserted in each of these pieces, which may be raised, or lower'd, by means of a row of holes in the standards, through which the iron pins are put, so as to give the axle tree room to rise to the height that shall be thought necessary to make the shares pierce to the intended depth, before the weight of the drill shall rest upon the axle tree.

That the axle tree moving on such rollers, will have less friction, or require less strength to make the wheels turn round, even when the weight of the whole instrument lies upon it, than it has in the blocks, with only the weight of the grain, is evident from the following fact. The gentleman who first thought of this invention, applied it to a roller of four tuns weight, which is now drawn with ease by two ordinary horses, even across his plowed grounds.

It appears from this easy motion of the roller, that there can be no danger of the axle tree's turning, though loaded with the weight of the whole instrument. Other considerable advantages will also arise from the drill resting thus on the wheels: for the labour of the plowman will be greatly lessened, the instrument will move steadier and more uniformly, and the draught will be much easier for the horses.

Mr. Duhamel does not seem to have provided sufficiently for covering the seed. We think that may easily be done, by fixing to the lower side of the table, a little behind each share, two thin plates of iron, or two pieces of board, in an angular form, but not quite joined together, thus $\vee$. They should reach, as nearly as possible, so low down as to be level with the surface of the ground when the shares have pierced to the depth intended. Their fore part should extend beyond the width of earth that is turned up by the share, which they will collect into the furrow; and being open behind, if they happen at any time to collect more earth than was turned off by the shares, it will escape through that opening, without clogging the drill.

* These rollers are made in great perfection, by Mr. Stevens, iron-monger, in the Hay-market, London.

CHAP. III.

OF HORSE-HOES.

SECT. I.

Description of M. Duhamel's Light Plough.

THE design of stirring the alleys has been so often, and so fully explained in the former parts of this work, that it would be needless to enlarge upon it further here. We shall therefore proceed to give a description of the instruments used for this purpose, beginning with M. Duhamel's light plough.

The hind part of this plough is exactly like that of a common plough, except that all the pieces of which this is composed are lighter.

AB, Pl. VI. fig. 1. is the beam of the plough: *A* is what is called the heel. The part of the beam from the coulter to *B* is round: the rest of it, to *A*, is eight square.

C, the coulter, which is fixed in the beam by wedges. The beam is strengthened on each side of the coulter, by two iron hoops.

D, the handles, which are joined to the beam towards their bottom, and of which the lower extremity is fixed into a piece of wood *AE*, called the ground-rest. This last terminates in a point a little beyond *E*, in order to receive the iron share *F*, which that extremity of the ground-rest is covered with. *G*, is the sheat, which is cut forked out of a piece of elm, and of which the two ends are fastened with a wooden or iron pin over the ground-rest, as at *E* on the left side.

H, is a piece of wood, the fore part of which is thinned to an edge: the upper part of it is fixed to the beam, and the lower part to the ground-rest.

G I H is a board cut somewhat rounding, and placed on the right hand side of the plough. It is called the mould-board, and its use is to turn over to that side, the earth which has been cut by the coulter, and opened by the share.

Underneath *H*, is a piece of wood which serves to support the mould-board in the middle, to prevent the pressure of the earth from bearing it down upon the plough.

The bottom of the ground-rest, from *E* to *A*, is trimmed with iron,

The double Cultivator.

Fig. 14.



View of the single Cultivator.

Fig. 2.



Scale of 3 feet for Fig. 4, 5, 6, & 7.
The others being seen in perspective require none.

Scale of 6 feet for Fig. 15.

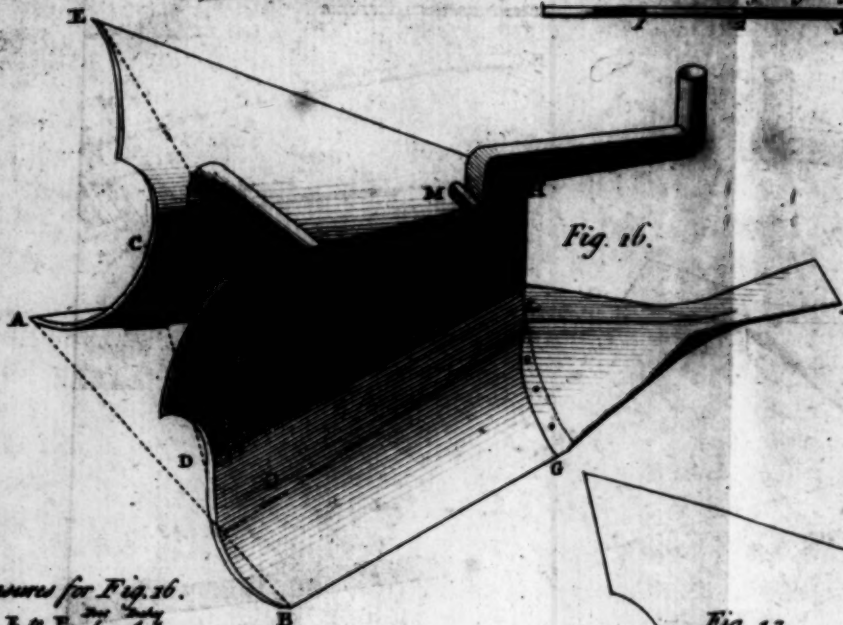


Fig. 16.

Measures for Fig. 16.

- from I to E..... $4\frac{1}{2}$
- from A to E..... $8\frac{1}{2}$
- from C to D..... $9\frac{1}{2}$
- from F to E..... 8
- from G to H..... $9\frac{1}{2}$
- from I to H..... 7

Fig. 17.



Fig. 21.

Fig. 22.

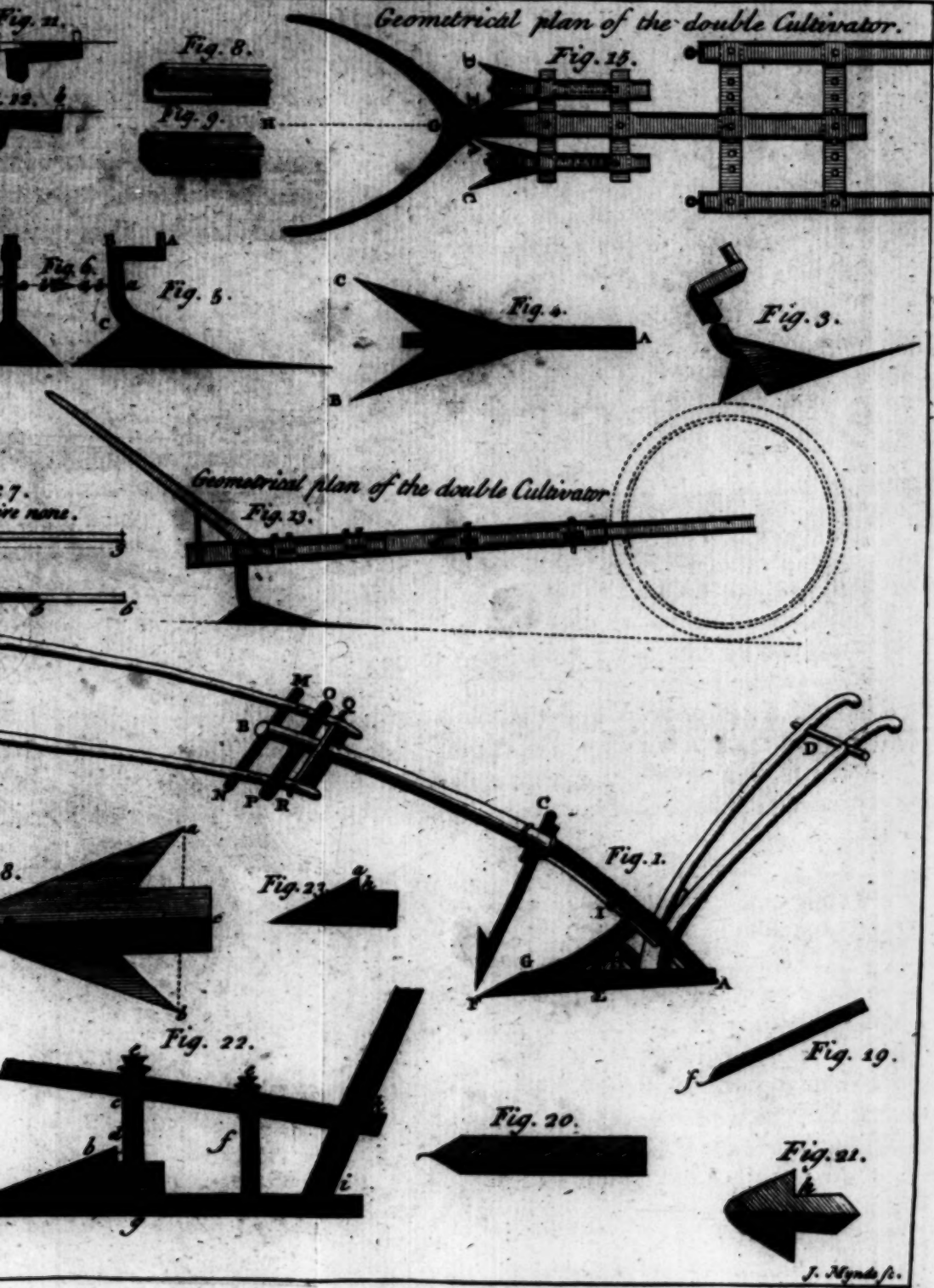
Fig. 30.

Fig. 7.

Fig. 6.

Fig. 18.





iron, to prevent its being worn by the continual friction of the earth.

This general description seems sufficient: for we believe one may use indifferently any common plough that has a mould-board, provided the fore-carriage and wheels be taken-off, and two shafts substituted in their stead, like the following.

KL, are two light shafts, which are fastened together by the cross staff *MN*, at such distance as to leave convenient room for a horse.

OP, is another cross staff, the ends of which rest upon the shafts, to which they are fastened by two iron pins. The end of the beam rests upon this cross staff.

It is easy to conceive, that the nearer this cross staff *OP* is set to the other cross staff *MN*, the deeper the share will penetrate into the earth: and the farther those staves are asunder, the less deep the plough will pierce. Either of these is easily done, by shifting the pins of the cross staff *OP* to the suitable holes in the shafts.

QR is the neck of this plough, which receives the beam through a round opening, wherein it turns with ease to the right hand or the left, but out of which it cannot slip, because it is stoppt by a strong iron pin driven through it.

This neck is formed of two semi-cylindrical pieces of wood, which are pressed one against the other by two screw trunnions; and two other trunnions *QR*, fix this cylinder to the ends of the shafts.

As the cylinder turns upon the trunnions at its ends, the position of the beam may of course be altered at will, so as to make the share cut more or less deep into the earth: and as the beam can turn in its neck, the plough may be inclined more or less to the right or left; which is necessary in order to plow well.

SECTION II.

Description of M. de Chateau-vieux's Single Cultivator.

AFTER having seen, says M. de Chateau-vieux, the effects of my plough for stirring the alleys between the rows of corn, I imagined that the instrument I am going to describe, which is much lighter and more simple in its make, would answer the same end; or at least that it might be used alternately with the plough, employing
 112 this

this last only when a greater quantity of earth is wanted to be turned up towards the rows of corn: for it is to be observed, that the *cultivator* hardly changes the situation of the earth, but divides and breaks it in the place it is in, so as to render it loose and light, and fit for the roots of plants to penetrate with ease. This instrument, like a miner, works chiefly under ground, where it cuts the earth, divides its particles, and raises it up and lightens it. It has this farther advantage, that one horse is sufficient to draw it. The cultivator, *Plate VI.* is composed of a beam *AB*, *fig. 2.* the handles *CD*, and the share *EF*, which is more particularly represented in *fig. 3, 4, 5, 6, and 7.*

The beam *AB* is three feet and a half, or four feet long. Its diameter ought not to exceed three inches, at most: and if it be square, the edges should be rounded off. It should be pierced with the mortises under the letters *G, H*, in order to let through the cross staves *I, L*, in the same manner as in the fore-carriage of the plough; and is fixed by the keys *K, M*, or the pins *a, b*. The middle of the handles should be over-against the beam, that is to say, the spaces between them should be equal on both sides. These handles should be made slighter than the plough itself, and they should be fixed to the beam by a tenon in a mortise, rivetted at *N*, and supported behind by the prop *P*.

The extremity *A* of the share, *fig. 4.* and the two pins *B, C*, are made flat. The crooked handle *ABC*, *fig. 5.* should be quite triangular, and somewhat sharp before, to answer the end of a coulter, as in *fig. 3 and 6.*

This share is to be let into a notch cut in the under part of the beam, as represented in *fig. 8 and 9*; and fastened there by a single ferril, as in *fig. 10.* If it should cut too deep, that may be remedied by altering the position of the wheel, as in the plough, or by inserting a very small wedge *g*, *fig. 11*, between the handle of the share and the beam. If it does not cut deep enough, that wedge must be inserted at *b*, *fig. 12*, at the other end of the handle, by the hook.

When this instrument is used, the beam before described is to be substituted in the place of that of the plough, which is to be taken off. The two cross staves *I, L*, *fig. 2.* of the fore-carriage of the plough, are then run through the mortises *G, H*, of the beam, by which means it is fixed thereto. This cultivator is very easy to guide: the plowman may hold it upright, or incline it to the right or left, just

just as the intended plowing may require. The share and its handle enter so deep into the earth, as to be quite buried in it, if a deep plowing is intended to be given: and in that case the tail *A* of the beam touches the ground. Tho' the share is but small, it stirs the earth at least a foot round it: its point should be of steel, and somewhat inclined towards the earth.

The share of this instrument, like that of the plough, may be brought as near as one pleases to the rows of corn, by placing the beam accordingly in the frame.

S E C T. III.

Description of M. de Chateau-vieux's Double Cultivator.

THIS instrument *fig. 13* and *14*, has two shares. It has a beam *AB*, and the shares *CD*, *EF*, which being exactly like that of the single cultivator, we have only to point out wherein these instruments differ. The beam of this should be 10 or 12 inches longer than that of the other. It has likewise two mortises more, under the letters *G* and *H*, to let through the cross staves *EK*, *IL*, which bear the handle *MN*, *OP* of the shares. The cross staves *EK*, *IL*, are rivetted permanently to the beam: the handles *MN*, *OP*, are moveable upon the cross staves, to which they are fastened by the keys *R*, *S*, *Q*, *T*; so that the shares may be set at a greater or less distance from each other, according as the quality or situation of the ground may require or allow.

This instrument stirs the earth extremely well, and does a great deal of work in a little time. Each share being about fifteen inches wide at *AC*, *BD*, *fig. 15*, and the distance between them from *A* to *B*, *fig. 15*, being about four inches, or, upon occasion, six; and the earth being stirred about two inches on each side beyond the extent of the outmost fins of the shares; each cut of this cultivator stirs about two feet breadth of ground. This double cultivator requires two horses, unless the soil be very light; in which case, M. de Chateau-vieux thinks one may do, tho' he says he has not yet tried it.

If one had a mind to fix a coulter in the middle of the beam, just before the shares, we see no inconveniency that could attend it, provided it be a very light one.

The way to use this cultivator, is to fasten it to the fore-carriage
of

of the plough, by running the two cross staves *F, X*, *fig. 14*, through the beam *A, B*.

M. de Chateau-vieux recommends particularly, not to make the wood-work of this cultivator too thick or heavy, and therefore by no means to exceed the dimensions here given: for the lighter these instruments are, the more easily they are managed both by men and cattle.

S E C T. IV.

Description of M. de Chateau-vieux's Cultivator with two mould-boards.

IF, says that Gentleman, I could have imagined, that my proposing for the use of the new husbandry some other instruments besides the plough, properly called, could have been looked upon as either so expensive or so troublesome, as to discourage people from practising that husbandry; I should by no means have thought of communicating them to the public.

But why should not agriculture enjoy the same advantages as almost all great manufactories, in which every useful discovery and improvement, either to perfect the manufacture, or to fabricate it in less time and with less expence, is readily adopted?

It is likewise with a view to facilitate the various labours of cultivation, to execute them better, more speedily, and with much less expence, that I have introduced the use of my new instruments in the culture of my lands. If others think proper to do so too, they will enjoy the same advantages. I offer them, not as things absolutely necessary, for the plough alone may suffice, but as things of which I have experienced the good effects during the years 1753 and 1754, and which, for that reason, I think it incumbent on me to recommend to the partisans of the new husbandry.

The cultivator with two mould-boards, differs from the single cultivator before described (S E C T. II.) only in those two mould-boards which I have added to it, one on each side, and which are represented in *Plate VI. fig. 16*. *A, C, E, H*, is the mould-board on the left hand side of the plough, and *B, D, G, H*, the mould-board on the right hand side. The whole of this *fig. 16*, represents an entire and a perspective view of the share and mould-boards.

The mould-boards are made of iron plates, either cast or hammered,

mered, about the twelfth part of an inch thick, which is sufficient to resist the pressure of the earth. Thicker plates than these would render the share too heavy, and it would be much more difficult to give them their proper bent.

The two mould-boards join to the handles at *HL*, and lap about an inch one over the other; or else they are fastened together by rivets. They form, in that part, an angle *E, H, F*, of somewhat less than 90 degrees, which is sufficiently acute to serve instead of a coulter: tho' a coulter may also be used upon occasion, by placing it a little more forward.

From the lower part *L* of the handles, the mould-board should pass underneath the fin *L, G*, of the single share, and follow the direction of that fin, as at *G*; being let in beneath, about an inch and an half, according to the pointed line *L, G*, and firmly riveted by three strong rivets.

The hind part of the mould-boards is fixed and supported by the stay *F*, to which they are strongly riveted. This stay must have exactly the same bend as the mould-board.

Behind the lower part of the handles is another stay, *M, N*, quite close to them, and about two inches below the top of the mould-boards, to which it is riveted at both ends. This stay helps to keep them firm: but its chief use is to prevent their being raised up by the pressure of the earth against their extremities *A* and *B*, which would throw their common angle *H* too forward, and misplace the share.

The proper slope of the mould-board cannot be so well described by words, as it may be conceived by the figure, which represents at *F* the convex inside of the one, and at *Q* the concave outside of the other. The distance to which the earth is turned over, when the cultivator opens it in order to make a large furrow, depends on the degree of this bending, and the space between the two upper extremities of the mould-boards, *E, F*.

The extreme back part of the mould-boards is cut sloping at *C* and *D*, almost in a segment of a circle. This shape helps to operate a greater division of the earth.

The plate of iron, before it is bent, should be cut nearly in the shape of *fig. 17*.

The size of the mould-boards, as well as the proper bending of them, depends a little on the quality of the land intended to be cultivated. I have found that, for light soils, they need not be bent quite

quite so much: so that the distance from *C* to *D*, *fig. 16*, may be twelve or thirteen, and even fifteen or sixteen inches. This same cultivator may likewise be used in stiff lands.

Nothing hinders making these mould-boards two or three inches longer, from *B* to *G*, and from *E* to *H*; nor varying some of their proportions, as the plowman may like best.

This share, with the mould-boards, is fixed to a beam, as in the single cultivator *fig. 2*, where it is fastened to the fore carriage by the cross staves *I, L*.

If this description does but convey a sufficiently clear idea of the shape and proportions of this cultivator, I will answer for its success when used. I describe it after one of the same kind, which I have made use of for two years past, with very great success.

Directions for using the Cultivator with two mould-boards, by
M. de Chateau-vieux.

IN my account of the experiments of 1753, I said that this cultivator opened the great furrow in the middle of the alley, by turning the earth over on both sides at the same time; and that as much work was done by that means, by one turn of this instrument, as could be done by two, and frequently three turns of the common plough, and that without using a greater number of cattle. I must now prove this proposition; tho' I am persuaded that it will easily be allowed by whoever only casts an eye on *fig. 16. Plate VI*, which represents the share of this cultivator.

The vacant space between the outmost row of corn on one bed, and the nearest row to it on the next parallel bed, which is what we have called the alley, and which is not sown at all, is the part that is to be cultivated at different times, from the first sprouting of the corn, till it is ripe.

The practice of the new husbandry has already shewn sufficiently, that too narrow alleys would scarcely answer any of the ends they are intended for; and that making them too wide, is a loss of ground. About four feet, exclusive of the spaces or partitions between the rows of corn in the beds, is a good middling width.

It is less necessary to make the alleys quite so wide in good soils: nor indeed do I think four feet so absolutely necessary at any time, but that a few inches less may do. An intelligent husbandman will easily judge what is most proper to be done in this respect. But what

what greatly merits the attention of every one, and ought never to be lost sight of, is, that wide alleys are more easily and much better stirred than narrower ones: for when an alley is wide, the great furrow in the middle of it may be cut deep, there being then sufficient space to turn the earth over towards the rows; whilst on the contrary, in too narrow alleys the earth cannot be stirred deep enough, nor can room be found for what is turned over out of the furrows, without danger of burying great part of the rows.

I therefore suppose the general width of the alleys to be about four feet. But the whole of that width is not to be plowed or stirred, either with the plough or cultivator, as soon as the field is sown. Neither of these instruments ought to go too near the rows of corn, for fear of rooting up the plants: but a slip of earth, about six inches wide, should be left untouched on the outside of each bed, by which means the part of the alley that is to be stirred, will be reduced to the breadth of three feet; and even that is lessened in the first plowing before winter, by a deep furrow which is then cut close to and all along those six inch slips, and the earth taken out of that furrow, or those furrows, is thrown into the great furrow in the middle of the alley, and serves to fill and arch it up. These two side furrows make together a width of about eighteen inches, and consequently leave in the middle of the alley a breadth of about eighteen inches more, on which is heaped up the earth thrown out of the two furrows: and thus the alleys remain all the winter.

The first hoeing in the spring, should turn back towards the rows of corn, the earth heaped up in the middle of the alleys. The two furrows that were opened before winter, are then filled up, and a new one is cut in the middle of the alley.

To perform this first hoeing with the common plough, which may very easily be done, two turns of that instrument will necessarily be requisite, viz. one on each side of the alley, as near as possible to the beds. But as even with those two turns, the furrow will frequently not be well formed, but a great deal of earth will still remain between it and the bed, a third turn of the plough is often necessary, and sometimes a fourth, to form the middle furrow as it ought to be.

To perform this work with the cultivator with two mould-boards, that instrument must be placed in the middle of the alley, and the horses in one of the two furrows. The share will easily enter, and

M m m

to a great depth, into the earth that was laid there by the last hoeing before winter: and as the horses advance, that great ridge of earth will be divided into two parts, which will be turned over into, and will fill up the furrows that were made before winter on each side of the alley, close to the beds. Thus, the great furrow in the middle of the alley will be opened, and the whole operation performed by one turn of the cultivator. The earth so turned over will be thoroughly stirred; and so much time and labour will be saved by this method, that the farmer may easily afford one or two stirrings more in the summer, which will always be of great service.

I have found so much benefit from making the furrow in the middle of the alley very deep, that I have sometimes given it a second plowing with the cultivator with two mould-boards, eight or ten days after the first; by which means I have cut it so deep, that I have been sure of having a depth of fifteen or eighteen inches of well loosened mould under the middle of my next year's beds.

My lands have been brought to so fine a tilth by the plowings of former years, that I have not had any occasion for a coulter to my cultivators: however, it may be proper to use one, where the ground has not been sufficiently loosened by the preceding culture.

To shew to what degree of pulverisation my lands have been brought and how extremely light they now are, I shall only mention the following fact. I used only one and the same cultivator with two mould boards during the whole course of the years 1753 and 1754, and never had occasion even once to have the share new pointed. The friction and resistance of the earth were so little in my grounds, that the point of my share was not worn at all, whilst, in the same years, my neighbours were obliged to have the shares of their common plough new pointed almost every day.

SECT. V.

Description of M. de Villiers's Cultivator.

THIS instrument is composed of a share, *Plate VI. fig. 18*, the two fins of which are eight inches and a half wide at their extremities *a, b*. The socket *c*, which is between the two fins, projects some inches, and the hollow in it is three inches long, and one inch wide. It does not descend so low down as the fins, to prevent its touching the earth. The length of this share, from the point *d*,

to

to the extremity of the fins *e* or *b*, is from 12 to 15 inches. Five inches from the point *d* is a hole *e*, into which is inserted the crooked point *f*, of the iron safeguard, fig. 19, which is used in this country in order to fasten the ear to the share of the plough. Upon the share is placed a small triangular ear *b*, fig. 21, 22, and 23; somewhat concave at bottom, that the two small ears may join exactly to the share at about an inch distance from the edge of the fins. This ear is about two inches and a half high at *e*, fig. 22, and is fastened firmly to the share by a double and angular safeguard, which covers its edge as far as *b*. It is fixed at one end by its point, which enters into the hole *e*, fig. 18, in the share, and by four small pins fastened to the ear. Fig. 19 and 20 represent this safeguard. The double ear is fastened at its other extremity, by the sheat, or upright piece *e*, g. fig. 22, which passes through the ground-rest of the hinder part of the ear and beam, and by a piece of iron *c d* bent in a right angle. This piece of iron covers the fore part of the sheat, and rests upon the tail of the ear, against which the beam presses it very tight, by means of a wedge *r*, driven into the sheat. The piece *c d* may likewise serve to fix two mould-boards from *g* to *e*. It is nine inches high. *f* is another sheat or upright piece, which joins the beam to the ground-rest, to add to the strength and solidity of the instrument, which is increased also by the lower part of the handles being fixed in the ground-rest at *i*, and traversed by the beam at *k*.

M. de Villiers, in a letter to M. Duhamel gives the following account of his manner of using this cultivator.

" Finding it, says he, impossible to plow my alleys well when
 " they were but three feet or three feet and a half wide, without
 " greatly damaging the rows of corn bordering on them; I resolved
 " to make them four feet wide, and took particular care to have the
 " rows drilled very strait. Even then, I found but one way of
 " plowing them well, which is, to open the first furrow so near the
 " bed, that the next furrow within that may come within two or
 " three inches of the nearest row of plants in the bed, turning over the
 " earth of these furrows towards the alley. After two or three such
 " turns of the plough, the plowman will be sure not to make any
 " mistake. It is of great importance to cut this first furrow, by
 " which all the others are directed, quite parallel to the rows. The
 " rest of the work will then go on regularly, and without any of
 " that confusion, which would be capable of giving many people a
 " dislike

dislike to the new husbandry. My horses were led by hand, till they were sufficiently accustomed to this work: but that was necessary only for the first furrow, which they afterwards follow of their own accord, by which means the rest of the alley is plowed with great ease.

The earth of the second furrow, which is cut very near the rows, is turned over in the same direction as that of the first: that is to say, from the bed.

The third furrow is plowed the contrary way, and the earth is now turned over towards the rows, so that the last furrow is filled up by this, and a considerable quantity of well divided earth is turned over to the rows, for the plants to extend their roots in the spring.

I then continue plowing in the same direction, cutting the furrow that is turned over towards the rows as thick as possible, till the whole alley is plowed almost close to the opposite bed, when, by turning over one large furrow on that side, the small one cut there at first is filled up. By this means the first spring hoeing is completely executed.

I begin the second plowing on the side where I ended the first, turning the earth over that way, which is the contrary of what was done before: and when I come to the other side of the alley, but I leave there, as was left before on the side I now begin at, the width of a small furrow, which I do not plow, but over which I turn the earth of my last furrow.

I think this second hoeing may be deferred, when the ground does not produce many weeds: and in this case I perform it with the cultivator, which I bring almost close to the rows.

After this using, sometimes the plough, and sometimes the cultivator, according as the condition of the ground seems to require, I finish all my hoeings by fastening two horses to the cultivator, and drawing it once or twice through the middle of the alleys; because it cuts four or five inches deeper than the plough.

M. de Villiers adds, that he could not always turn the earth over towards the rows, as M. Duhamel directs, because the wheel of his plough, getting too deep in the middle furrow, altered the direction of the share. To this M. Duhamel observes, that he himself met with the same difficulty, and found no other way of remedying it, but by opening a small furrow near the rows, by the help of which he turned the earth over towards the alleys, and then filled up that furrow

furrow immediately, taking care at the same time to turn the mould over to the roots of the plants, so as to earth them up as much as possible. "I am glad, adds he, that I have had this opportunity of giving M. de Villiers's method, because I think it a good one, and believe it will be of great service to such as may be inclined to practise our new husbandry."

Observations on Horse-hoeing, by M. de Villiers.

"I Have tried, says this gentleman, to hoe my alleys after M. de Chateau-vieux's method, which I look upon as the best and most expeditious, notwithstanding that several difficulties which I have met with in the practice of it, have obliged me to give it up. For example, the great furrow in the middle of the alley is, according to his directions, to be filled up by two turns of the plough, one on the right hand, and the other on the left, after which it is to be opened again by one turn of the cultivator with two mould-boards, or two or three turns of the common plough.

"When I set about this work, the first turn of the plough, if the share went to any depth worth speaking of, always filled up the furrow in such manner, that to prevent its being poached by the horses, I tried to make them walk on one side, on the upper ground, and consequently very near the rows of corn: but then, in the first place, I could not avoid the destruction of a great number of plants, without giving such attention as was not only excessively troublesome, but almost impracticable: and secondly, I could plow only the surface, because as the furrow was filled, the plough could turn up but very little earth, without being choaked and becoming extremely heavy.

"If, to save the plants, I made the horses tread partly on the mould turned over into the furrow, the plough choaked equally, and for the same reason, whenever the furrow was cut deep. All I could do in this case, was to give only a superficial plowing: and with that it was impossible to use the cultivator with two mould boards to form the furrow, because that instrument cannot operate in any but a loose well-tilled ground.

"All these inconveniences may not happen in a soil different from mine. I am the more inclined to think this, as M. de Chateau-vieux certainly does not experience them: but at the same time I must also observe that that justly celebrated gentleman has instru-

ments

ments so perfect, and directs his servants with such superior judgment, that few can expect easily to equal him in the practice of the new husbandry.

Not being able, for the above reasons, to do with one turn of the cultivator with two mould boards, what, as M. de Chateauvieux himself observes, can frequently not be done with less than three or four turns of the common plough, which added to the two turns that are given to fill up the furrow, make in all five or six turns; I pursued, and with great advantage, nearly the method before described. I say nearly that method, because I have made some few alterations, by which I think it is rendered both easier and better.

1. I make the mould-board twelve or thirteen inches deep, instead of nine or ten that it was before. The furrows are by this means made wider, and the plough is more easily drawn, because it finds more room to discharge its load of earth in, and suffers less pressure.

2. To give the second hoeing with the plough, instead of continuing to turn the earth over towards that side of the alley where I turned up but one furrow when I finished the first plowing, I, on the contrary, begin this second at that furrow, approaching, if possible, to within two or three inches of the row of corn; and then I make a furrow in the contrary direction, which turns the earth up against that row.

My reason for plowing so near the rows, when I give this second hoeing, is, that I have observed that the rains which fall pretty frequently in the spring, between the first plowing and the second, harden the earth greatly, and that drought afterwards hardens it still more, so that the roots of plants can no longer pierce or spread in it with ease: and yet nothing is more necessary, in order to their being benefited by every culture of the earth, than that they should find an easy passage into the mould that lies next the rows. It is therefore highly proper to stir that mould, when the second hoeing with the plough is given, which, with me, is when the corn has begun to spindle; that being the time when the plants push with the greatest strength, and when their roots ought consequently to begin to extend to some distance.

I have not perceived that the plants have been at all hurt by the plough's coming so near them. They ought to be so much the less hurt thereby, as the rows are placed over a furrow which has been

“ been cut deep; that situation being alone capable of making the
“ corn tiller, and push strongly: though the assistance of culture is
“ likewise necessary, to supply the stalks and ears with plentiful nou-
“ rishment.

“ I am the better pleased with this method of bringing the hoe-
“ plough almost close to the rows, as it facilitates a very important
“ operation, strongly recommended by M. Duhamel, and which I
“ never before thought practicable: I mean the raising up of the
“ earth about the bottom of the plants, as well to give them greater
“ nourishment, as to prevent their being lodged. The following is
“ my method on this occasion.

“ When I fill up the furrow which I have cut as close as possible
“ to the row, I hold the plough sloping, in such manner that the
“ earth is forced away from it, and is raised up about the plants.
“ If this slope is not sufficient, which may sometimes depend on
“ the condition of the ground, or the dexterity of the plowman, I
“ in that case make the mould-board two or three inches wider,
“ when I use it to fill the furrow, than it was when I made that
“ furrow: and to that end I screw on to the extremity of the mould
“ board, a thin plate of iron about four or five inches wide. Those
“ who practise the new husbandry in so extensive a manner as to em-
“ ploy several ploughs, will find no inconvenience in having one,
“ larger than the rest, purposely for this important operation. As
“ I do not give this second hoeing with the plough, till after the
“ corn has begun to spindle, it is easy for me to avoid burying the
“ plants, especially if there are no great clods in the ground: but at
“ all events I always earth the plants up as much as possible, when
“ there is no other danger than that of burying here and there a few
“ of them; because that accident is easily remedied afterwards, if it
“ be worth while.

“ When I am to give the third hoeing with the plough, I con-
“ sider the condition of the ground. If it is in good tilth, well
“ loosened, and free from weeds, I use only the cultivator: other-
“ wise I use the plough, three or four turns of which are sufficient
“ to perform this operation, in the following manner.

“ The first cut turns the earth over into the middle furrow; the
“ second and third are in a contrary direction, and the fourth takes
“ up what was loosened by the third, whereby the furrow is repla-
“ ced in the middle of the alley. Some time after this, and espe-
“ cially if a shower of rain has fallen, I cut that furrow still deeper,
“ by

“by one turn of the single or double cultivator, as M. de Chateau-
vieux directs.

“But as, even after all these plowings, the great furrow may
“chance to be neither deep enough, nor sufficiently cleared of mould,
“owing either to the imperfection of the instruments made use of,
“or to the inaptitude of the plowman; that defect may easily be
“remedied after harvest, by giving one plowing more, which is to
“be begun by throwing up the earth to the right hand and the left,
“towards the summit of the beds, that is to say, over the stubble.
“This practice is also confirmed by M. de Chateau-vieux’s in-
“structions.

“The one plowing extraordinary which this operation requires,
“ought not to be thought much of; because the most important
“thing in the new husbandry certainly is, the providing of a good
“depth of well stirred mould, for the plants to extend their roots
“in.”

CHAP. IV.

OF GRANARIES.

THO’ we are not, in this kingdom, under the same necessity
as some foreign countries, of building large edifices for gra-
naries, because our harvests are much less apt to fail us; yet, as it
must be of great advantage to every farmer to be able to preserve
a large quantity of grain in an inconsiderable space, where there
will be no danger of its heating and fermenting, where it will be out
of the reach of animals and insects to prey upon it, and where
there will be no fear of the ignorance or want of judgment of the
person intrusted with the care of it; to obtain these advantages
without much cost or trouble, we think it will be right to give some
directions for this purpose, which it may be in the power of any
one to put in practice: referring those who can afford to be at a
more considerable expence, to the larger means pointed out by
the writers on this subject. Among these, the first place is most
deservedly given to that beneficent friend to mankind, the Rev.
Dr. Hales. M. Duhamel has more particularly applied the use of
ventilators to the preservation of corn, and has likewise added the
use of stove-granaries. As the erecting of these last is attended
with an expence which the generality of farmers can seldom afford,

we

we take this opportunity of acquainting them, that the kiln may be substituted in their place, and with nearly equal advantage; especially where the quantity to be dried is not very great: and in regard to publick granaries, we recommend to the perusal of the curious, as well worthy their attention, an ingenious performance* lately written on that subject, by a lady of our own country.

The editors of Mr. Lisle's husbandry having given a concise abridgment of the experiments in M. Duhamel's treatise on the preservation of corn, we shall copy from them what is most essential therein, and then add the farther experiments mentioned by that gentleman in his treatise on agriculture.

M. Duhamel caused a case or little granary to be made, of oak plank two inches thick, forming a cube of five feet every way. At six inches from the bottom, he made a flooring, or second bottom, of lattice work, placed upon joists of five inches thick, covering it with a strong canvas: and this little granary was filled quite full of good wheat. It contained ninety-four cubic feet, weighing five thousand and forty pounds.

This granary, being filled quite full of corn, is to be covered with good oak planks, so closely joined, that neither rats, mice, or even the smallest insect can get in; leaving only some vent-holes, with trap-doors, or covers fitted very exactly to them, which will be spoken of hereafter.

By this means the corn is deposited in a small compass, and perfectly secured from rats, mice, birds, and even insects, provided there were none before in the granary, or among the corn: but if there should, the means hereafter pointed out will destroy them.

It is well known that, in this climate, corn laid up in great heaps will soon ferment and spoil: to prevent which, it is necessary to force out the tainted air, and supply its place, from time to time, with fresh: in short, to establish a current of air, which shall pass through the corn, and carry off the dampness. To this end, M. Duhamel made a false bottom of lattice work, covered with coarse canvas, (but if it were for a large granary, wire, in the manner of a sieve, might do better,) through which the air could pass, and be forced out at the vent holes at top.

This purpose is answered by bellows, and the most proper for this end are those contrived by doctor Hales, they being constructed

* A plan for erecting publick granaries.

without leathery; or any other matter liable to be destroyed by vermin.

A large pair of these bellows being so fixed as to receive the air from without, and convey it between the bottom and false bottom of the granary; when you would ventilate the corn, open the vent-holes at top, and work the bellows, which will drive the air through the whole body of the corn with such force as to make the dust fly out of the vent-holes, and when confined to one small opening will blow up some grains of corn a foot high. The vent-holes may be covered with a close wire-lattice, to keep vermin out.

It is of great importance that the corn be well cleaned before it be put into one of these granaries; because it must continue there till it is made use of: and particular care should be taken that there be no smutty grain mixed with it.

The corn I chose for this experiment, continues M. Duhamel, was of a good quality. I ventilated it not more than six days in a year, without the help of fire, which was sufficient to keep it so well, that the most skilful allowed it to be as good as could be.

When the bellows had not been worked for some months, the corn was allowed, by good judges, to look and smell perfectly well: but they objected that it did not handle well, that is, that it had some little dampness in it. The bellows were worked for half a day, and that objection was entirely removed.

In hot countries, corn may be preserved a long time by being deposited in a vault or cistern, so closely stopped that the air can have no access: but experience shews, that this method will not succeed in our climate, the sun not having power to exhale the moisture from the corn, sufficiently to prevent its fermenting when laid in a large heap: and this is farther proved by several experiments of corn dried in a kiln, which, tho' its weight was considerably diminished, did not lose its vegetative quality, but grew very well.

From these observations it follows, that it is necessary to take away the superfluous moisture, and bring our corn to the same degree of dryness as that of the hottest countries, in order to preserve it in great quantities.

Experi-

Experiments on ninety-four cubic feet of wheat (not dried) which was preserved above six years by ventilation only.

IN May, 1743, ninety-four cubic feet of wheat was put in one of the little granaries before-mentioned. It was of the harvest of 1742, and of an excellent quality, perfectly clean, and so dry, that it lost only one-sixteenth of its weight upon drying a small quantity of it, for a trial, on a kiln with the heat at fifty degrees of M. de Reaumur's thermometer. This wheat was well cleaned from dust, and deposited in the granary without being dried by fire.

During the first three months, it was ventilated for eight hours once a fortnight: the rest of the year 1743, and all 1744, it was ventilated once a month: all the year 1745, and part of 1746, it was ventilated half a day once a month; and after that, but once in two or three months.

In June 1750, the granary was emptied, and the wheat look'd and smelt very well, but felt a little rough in the hand, because, not having been moved for six years, the little hairs that are at the extremity of the grains, and the particles of the bran, were roughed up; but after passing twice through the wind screen, that objection was entirely removed. We caused some of this corn to be ground, and made into bread, which proved very good. To be still more certain of its quality, we sent some of it to market, where it was sold in small quantities to the bakers, without saying how it had been kept, lest that should prejudice them against it. After having used it, they acknowledged that it made excellent flour, which took more water in kneeding, and yielded more bread, than any other.

This was corn of eight years old, seven of which it was preserved in the granary, without any sensible diminution, and without any damage from rats or other animals: it cannot be said, without any expence, because a man was employed from time to time to ventilate it: but it is very easy to reduce that expence almost to nothing, as will be shewn hereafter.

The Rev. Dr. Hales proposes the following method of preserving corn, as a thing that may be very beneficial to the poor, who frequently keep small quantities of corn in sacks.

"Provide a reed-cane, or other hollow stick, made so by glewing together two sticks grooved hollow: let it be about three feet

" nine inches long ; and, that it may be the easier thrust down to
 " the bottom of the corn in the sack, its end is to be made taper
 " to a point, by a wooden plug that is fixed in, and stops the ori-
 " fice. About an hundred and fifty small holes, of one eighth of
 " an inch diameter, are to be bored on all sides of the stick, from
 " its bottom, to two feet ten inches of its length ; but no nearer
 " to the surface of the corn, lest too great a proportion of the air
 " should escape there. By wreathing a pack-thread in a spiral
 " screw-like form round the stick, the boring of the holes may
 " be the better regulated, so as to have them about half an inch
 " distant towards the bottom, but gradually at wider distances, so
 " as to be an inch asunder at the upper part : by which means the
 " lower part of the corn will have its due proportion of fresh air.
 " To the top of the stick let there be fixed a leathern pipe ten
 " inches long ; which pipe is to be distended by two yards of spiral
 " wire coiled up within it. Or a tin pipe may be fitted to it for
 " the same purpose, having a piece of leather fastened to the other
 " end, to receive the nose of the bellows. At the upper part of
 " the pipe is fixed a taper wooden faucet, into which the nose of
 " a common household bellows is to be put, in order to ventilate the
 " corn.

" If corn, when first put into sacks, be thus aired every other, or
 " third day, for ten or fifteen minutes, its damp sweat, which
 " would hurt it, will, in a few weeks, be carried off to such a de-
 " gree, that afterwards it will keep sweet with very little airing, as
 " has been found by experience.

" By the same means many other kinds of seeds, as well as corn,
 " may be kept sweet, either in sacks or small bins : but then in
 " bins the air-holes must be made only near the bottom of the
 " canes, because the air must in that case all ascend upward, since
 " it cannot go through the sides of the bin, as it will through
 " sacks."

*Experiments on 75 cubic feet of new wheat, extremely moist, and
 which had already contracted a bad smell.*

THE harvest of 1745 was very rainy, and all the corn had grown
 in the ear. In the common granaries, it was always in a state
 of fermentation, tho' laid but a foot deep, and turned every four or
 five days.

Seventy-five cubic feet of this grown corn, which smelled very ill, and was so moist as to wet the floor of the granary where it lay a few days, were put, in this condition, and without being dried, into one of our little granaries, with small hopes of success. The sheaves were moist when they were threshed; the grain was bruised under the flail, for want of its easily quitting the ear; and if it remained but a short time on the floor of the barn before it was cleaned, it heated and contracted a smell like that of pigeon's dung. It was so moist, that in a stove heated to 50 degrees of Reaumur's thermometer, it lost an eighth part of its weight.

As the corn was very hot when put into the granary, it was ventilated three or four times the first week, and once a week during December and January: and as it had lost great part of its bad smell, from that time till June it was ventilated but once a fortnight.

Then, perceiving, by the running of one's hand into the top of the heap, that it heated, we concluded it was going to be entirely corrupted; which determined us to empty the granary: but when we had taken out about a foot of the top, we were greatly surprised to find the rest cool, with very little bad smell, and drier than that which was preserved in the common granaries.

The reason why the top was the worst, was, the moist vapours being always forced upwards in ventilation: and we apprehend that if, instead of emptying the granary, it had been ventilated oftener, the moisture that was at the top might have been dried away.

This experiment teaches us one important thing, which is, that in this sort of granary the top of the heap is most subject to heat; so that if the grain taken out of the vent-holes is in good condition, you may conclude the rest to be still better.

Where the corn is too moist for the granary, M. Duhamel proposes drying it in a stove, of which he gives a particular description, previous to its being put into the granary of preservation. That the kiln will nearly answer the same purpose, appears by what Mr. Tull relates of a neighbour of his in Oxfordshire, who acquired a large fortune by this practice. His method was, to dry his wheat on a hair-cloth, in a malt-kiln, with no other fuel than clean wheat-straw; never suffering it to have any stronger heat than that of the sun. The longest time he let it remain in this heat, was twelve hours; and the shortest time, about four hours: the damper the wheat was, and the longer intended to be kept, the more drying it

it required: but how to distinguish the degrees of dampness, and the number of hours proper for its continuance on the kiln, he said, was an art impossible to be learnt by any other means than practice. His speculation, which put him upon this project, was, that it was only the superfluous moisture of the grain that caused its corruption, and made it liable to be eaten by the weevil. When dried, the bakers allowed it to work better than new wheat, and every grain would grow after it had been kept seven years. Mr. Tull adds, that the most secure way he knows of preserving wheat, is by drying it.

Experiment on 90 cubic feet of fine wheat, which was preserved without ventilation, after having been dried on a kiln.

THIS wheat, tho' very full of smut and dust, was so well cleaned as to have no fault remaining but dampness. It was dried in a kiln, by which it lost a little disagreeable smell it had before; and when it was thought to be sufficiently dried, it was laid up in one of our granaries of preservation, which had bellows adapted to it: but there was no occasion to use them.

It appears by this experiment, that wheat well cleaned and dried need not be ventilated.

Experiment on 75 cubic feet of small wheat, mixed with smut, which had been dried on a kiln.

OUR different screens clean'd the large wheat perfectly; but with all our care we could not free this small wheat from smut, dust, &c. of which much remained, and the kiln did not clear it from the bad smell it had contracted.

Frequent ventilation would undoubtedly have taken away that bad smell: but this experiment being to try the effect of the kiln only, we determined not to ventilate, unless there was great danger of the wheat's corrupting, which did not happen: but yet the bad smell increased so much, that we were obliged to stove dry it again after it was taken out of the granary, and to screen it several times, by which means it made tolerable good bread.

This experiment shews, first, how necessary it is to clean the corn well before it is put into the granary of preservation, and that, in some cases, both ventilation and stove drying are necessary: secondly,

condly, that corn which has contracted a bad smell, may be cleared of it by the kiln and wind-screen.

Having found by the foregoing experiments, that good corn, well cleaned, and properly stove dried, may be preserved without ventilation; and that good corn tolerably dry may be preserved by ventilation only; we conclude, that it must be most advantageous to join both methods, especially for large granaries.

Experiment on 825 cubic feet of fine wheat lightly stove dried, and ventilated.

THIS wheat was of the year 1750, and consequently but of a middling quality. After being well cleaned, and lightly stove dried, it was put in the granary of preservation, about seven feet deep, which granary had bellows worked by a wind-mill.

This corn had a bad smell, which was not entirely dissipated by the kiln, but it was quite cleared of it by ventilation. It was not only well preserved thereby, but was so meliorated, and became of so good a quality, that the bakers preferred it to all other, and gave two-pence a sack more for it, than for the same wheat preserved in the common way.

It is certainly most advantageous to unite both methods, not only because they are most effectual in preserving corn, when joined together, but also because they are then least troublesome and expensive: for to stove dry it sufficiently to keep without ventilation, requires a large fire and long attendance; and to preserve it without stove drying, will require very frequent ventilation; whereas, by joining the two methods, both are rendered very easy and less expensive, and the success is more certain.

Dr. Hales observes, that kiln-drying often makes corn grind unkindly; and therefore proposes the following method of drying smutty corn, after it has been washed; cold air not hurting it, as kiln-drying is found to do. "That I might be well assured, says he, of the good effect of thus drying smutty corn, having procured a quantity of very smutty wheat, which weighed seven pounds and fifteen ounces; on the twenty-sixth of May, at five in the morning, it was washed clean in four several waters, which was done in a few minutes, and was then laid to drain in an oat-sieve, till half an hour after five, when it had increased in weight, by wetting, ten ounces, besides the moisture that was equal to the weight of the smut-balls and smut that was washed from the wheat.

“wheat. It wasted but two ounces and an half, by the first two
 “hours ventilation; two ounces and five drachms in the second two
 “hours, viz. from eight to ten; in the next six hours, viz. from
 “ten to four in the afternoon, it wasted at the rate of four ounces
 “every two hours; from four to six, two ounces and an half; and
 “from six to eight, one ounce and an half: in all, about twenty
 “ounces: some allowance being made for what corn was wasted by
 “handling and biting some of it from time to time. It was venti-
 “lated in these fourteen hours with about forty thousand gallons of
 “air, which passed upwards through it, and made it sufficiently
 “hard and dry, so as to be fit for grinding: it was well coloured,
 “and handled well; and, from stinking, as smutty wheat does,
 “it became much sweeter. The visible dewy moisture was blown
 “off in three hours; but it continued damp and cold to the feeling
 “till two o'clock, when some little dust began to fly off it.

“And whereas it wasted off much less moisture during the first
 “four hours ventilation, when it ought to have wasted the most;
 “on account of its being then wettest, this was owing to the foggy
 “haziness of the morning: which as it went off, and broke out
 “into fine warm sun-shine, towards ten o'clock, so the air being
 “thereby become dry, it imbibed moisture more strongly from the
 “corn: and that this was the true cause of the difference, is far-
 “ther confirmed by a like experiment which I had before made on
 “a gallon of wheat, April the first, there being then a very dry
 “north-east wind.

“It will be advisable to begin to ventilate corn as soon as possi-
 “ble after washing it, that the moisture may have the less time
 “to soak in: for the less the moisture soaks in, so much the sooner
 “the corn will dry.

“If the moisture is so easily carried off from wet wheat, by
 “ventilation, this method will doubtless much improve what is
 “called cold wheat, viz. such as is grown, and has been housed
 “in a cold wet season; and will therefore soon carry off the moist
 “vapours which arise from corn, and cause it to heat and grow
 “musty.”

Of the Moth, or Worm.

IN all our experiments, says M. Duhamel, we have never suffered
 any thing by moth or weevil, though the common granaries were
 greatly infested with them at the same time. This is a good prog-
 nostic :

hostile ! but we must not conclude from hence, that this method will absolutely prevent the mischief. It may be supposed, that the care we had taken, in these experiments, to clean the corn, had entirely freed it from them ; and it may be objected, that this great care cannot be taken in large stores, and that, if any should get into the heap, they would be by so much the more dangerous, as they would remain longer undisturbed.

The moth lays its eggs on the corn, and those eggs produce worms or caterpillars, which feed on the corn, and spin a silky web, which extends sometimes to three or four inches deep, and entirely spoils all the grain within that depth, besides communicating a bad smell to the whole mass.

In the winter of 1746, we collected from our ordinary granaries all the wormy crusts thus formed, which were very thick, the moths having been very numerous the preceeding summer : these crusts were broken and screened, and what grain could be got from them, which undoubtedly was impregnated with the eggs of the moths, was put into one of our granaries of preservation, which contained seventy-five cubic feet, and was ventilated from time to time all the winter.

About the end of May, if the vent-holes at top were opened, a vast number of moths flew out, which shewed they did not like their situation.

In June 1747, the granary was emptied : the moths and worms had all perished, and there remained only a thin crust, about one eighth of an inch thick, on the top of the corn, which had so far lost the bad smell it had when put into the granary, that it sold for the current market-price.

Of the Weevil.

THE weevil is of the beetle kind. It devours a great quantity of corn, as well old as new, but does not communicate any bad smell to it, as the moth does. It will endure the heat necessary for kiln-drying, and is numbed, but not destroyed, by intense cold. The weevils are generally found collected in heaps, which feel very warm. This warmth is probably necessary for hatching their eggs ; and if so, they will not be in a condition to propagate their species in our granaries. No smoke will destroy them,

them, but that of sulphur; and that gives a bad smell to the corn.

In May 1751, we put some weevils into one of our granaries; and when it was opened in August 1752, we found none.

M. Duhamel, in the fifth volume of his *Treatise on Agriculture*, gives the following farther experiments on the preservation of corn.

Experiments made at Denainvilliers, on the preservation of corn.

THE wheat of 1754, being of an excellent quality, and that harvest having been very fine and dry, my corn, after being kept all the winter in a common granary, was divided into two parts, one of which was deposited in one of our granaries of preservation, without being stove-dried; concluding that, as it was so well conditioned, the renewing of the air with the bellows, would be sufficient to preserve it. In effect, this corn remained always cool and in good order.

The other part was stove-dried and laid up in another granary of preservation; where, as it did not heat at all, I am apt to think it would have kept without the assistance of the bellows: but this is only a conjecture; for it was ventilated nearly as much as the other.

In my treatise on the preservation of corn, I mentioned my having kept wheat seven years, without its being attacked by any insect: but indeed it had not weevils in it, when it was put into the granary, which was always kept so closely shut, that there was not the least room for that insect to get in any where. I likewise said in the same work, that after having laid up in a granary of preservation, wheat which had been stove-dried, and put some weevils in among it, not one of them was to be found when that granary was emptied eighteen months or two years after.

The case was not the same this year. I had put some weevils into the granary in which I laid up wheat, not stove-dried, of the harvest of 1754.

In May 1756, wanting to lay this wheat, which had not been stove-dried, upon some other which had been dried, in order to empty one of my granaries for wheat of the harvest of 1755, I ordered it to be sifted through a wire screen, and found, while that was doing, nearly the same quantity of weevils that I had put into it. I have

have reason to think they had not multiplied; because it is well known that this insect heats prodigiously the corn it gets among, either in the granary or the barn; and the corn I am speaking of was so cool, that a country fellow whom I employed for this work, could hardly remain bare-footed amongst it. When the time shall come round for emptying this granary, in which there now is wheat of the harvest of 1754, part stove-dried, and part not dried, I shall take care to examine whether the weevils have increased. Hitherto, this corn has always been very cool.

In May 1756, I stove-dried corn of the harvest of 1755, in order to put it in the same granary of preservation in which I had kept that of 1754 not stove-dried.

This corn of the harvest of 1755, having been reaped in rainy weather, continued extremely damp; and tho' care had been taken to turn it every week, from the time of its being removed out of the barn, it had contracted a very bad smell, pretty much like that of pigeon's dung. I therefore determined to stove dry this corn for 48 hours. A putrid smell issued from it. After this corn had been thus stove-dried, I had it sifted immediately, to cool it and cleanse it from that small dust which falls off dry corn. After this, I put it into a granary of preservation, and ordered it to be ventilated more carefully than old corn.

This wheat has never heated, but has always remained perfectly cool, and has quite lost its bad smell.

We see by this experiment, an instance of the good effect of the stove, since it rendered capable of being preserved, wheat which could not have been kept in the common way. The stove likewise destroyed the bad smell which would have lessened the price of this corn very considerably. At the same time a parcel of wheat of the same crop, which had begun to grow, and had contracted a very bad taste, was stove-dried with still more care. It dried perfectly, was in excellent condition for keeping, and had no bad smell: but if it was chewed, it had a disagreeable taste, and the dough made of this grown corn, which seemed to have been so well recovered, did not rise in the kneading-trough, and the bread made of it was very heavy and of a disagreeable flavour.

As I had not yet tried any experiment on the preservation of barley and oats, I filled two small granaries with these grains, without stove-drying them.

The oats remained cool, and kept extremely well: but the

barley emitted so great a quantity of moisture, that the boards at the bottom of the granary were quite warped by it: and this grain heated to such a degree, that the bellows worked by hand could not cool it, tho' constantly applied for eighteen months together. When this granary was emptied, we found the boards covered with a stinking glutinous moisture, which had communicated itself to the whole mass of this corn. I then judged that all of it was spoiled, especially as the heat had spread to every part of the granary, and the outside of the corn was rotted all over for near two inches deep, and stuck to the sides and bottom of the granary. I likewise perceived that a prodigious number of weevils had bred in this granary. Notwithstanding all this, I resolved to try whether I could make any thing of this corn. To this end, I ordered it to be put into my stove, after which I sifted and winnowed it, to clean it of the grains that had no flour in them, which were pretty numerous. This operation lessened the mass by about one twelfth: but the good corn was very dry, and had no bad smell. I have put it back into the same granary, to see whether it will be possible to keep it after this stove-drying.

Experiments on the Preservation of Corn, by Dom Edward Provenchere, Procurator of the Carthusians of Liger, near Locbes.

IN 1755, Dom Edward intending to make some experiments on the preservation of corn, chose for that purpose a large cask, at one end of which he put a double-barred grate, and over that a canvas. This cask was filled with wheat of the harvest of 1754, not stove-dried, and contained 1100 pound weight. He then fixed to it a pair of middle sized bellows, so situated that they might easily be worked. Nearly in the center of this corn, he put as many weevils as weighed six drachms, which is pretty considerable for that quantity of corn.

The bellows were blown an hour every week. In the beginning of September, when that operation had been neglected for some time, the corn began to heat; but it was soon cooled again by using the bellows. The 15th of October, on taking the corn out of this cask, in which it had kept perfectly well, not above twenty weevils were found in it. Dom Edward says he saw that insect come out of the cask every time the bellows were blown. He perceived in many places several grains of corn fastened together by threads, which had been certainly formed by moths that were in this corn which had not been

been stove dried, and, not dying immediately, had had time to spin their web. The experiments, adds M. Duhamel, which I have related in my treatise on the preservation of corn, have, I believe, proved sufficiently, that this insect cannot breed in granaries made after the manner there directed. I wish I had as strong proofs of their destroying the weevil.

Dom Edward filled another cask with 900 weight of barley, not stove-dried, and put into it six drachms of weevils. Tho' care was taken to ventilate this cask, as much as the former which was filled with wheat, that is to say, during an hour every week, yet this corn heated prodigiously: the bellows could not cool it, and the weevils multiplied in it exceedingly. This is the very thing that happened to me in my larger experiment on the same kind of grain, and which I mentioned in the preceding article. Barley probably contains a great deal of moisture: and the question is whether stove-drying can be able to preserve it. This increase of the weevils seems to prove what I said before, that this insect cannot multiply in corn that retains a proper degree of coolness.

Experiments on the preservation of corn, made at the royal abbey of St. Stephen of Caen, by Dom de Sainte Affrique, prior of that abbey.

DOM de Sainte Affrique kept 1200 bushels* of wheat in a granary like those described in our treatise on the preservation of corn.

This granary was 12 feet wide, 13 feet long, and 6 feet deep; which forms a parallelepiped of 936 cubic feet.

The wheat that was laid up in this granary of preservation, had not been stove dried; but had been kept all the winter in a common granary. It was cooled from time to time by two bellows, which two men worked by means of a lever.

Tho' the place in which this granary of preservation stood, was neither so dry nor so airy as might have been wished, the corn kept perfectly well in it.

Fully satisfied with this trial, Dom de Sainte Affrique intends to have large granaries built, with a stove to dry the corn, and a mill to work the bellows. If he puts this in execution, he will render an important service, not only to his abbey, but also to the public: because he will thereby be enabled to apply to a larger object than has

* The Caen bushel weighs 45 pounds.

hitherto fallen in our way, principles of which we think we have demonstrated the certainty and the utility, and which we could wish to see adopted by greater numbers of people.

Experiments on the preservation of corn, by M. Vandusfel.

IN the beginning of September 1754, M. Vandusfel filled one of M. Duhamel's granaries of preservation, seven feet square and six feet deep, with good wheat not dried. It heated a little at the end of eight days; but two men, with a small double ventilator, cooled it in two hours time. It began to heat again about a week after, when he repeated the same operation, which cooled it presently; and on the 20th of October it was quite cool, tho' it had not been ventilated for fifteen days.

M. Vandusfel, in a letter to M. Duhamel, dated the 14th of October, 1756, tells him, that his corn still continued in the same good condition. He adds, that in August 1756, he filled a small granary with dried corn, which had kept perfectly well to the time of his writing, without being ventilated at all. Corn of the year 1754 and 1755, not dried, but only ventilated, had likewise kept as well as could be wished: and a parcel of corn which he dried and put into casks, remained six months in them, without being ventilated, and was perfectly sound at the end of that time. However, he observes, that both dried and undried corn, if suffered to remain a month without being ventilated, contracts a disagreeable smell, which is perceived when the bellows first begin to work, but is entirely dissipated in a few minutes. This smell is not a symptom of corruption or decay, but only a strong smell of corn, such as is always perceived on entering into a granary that has been shut for any length of time.

CHAP.

C H A P. V.

OBSERVATIONS on the WEATHER, made during the years 1755 and 1756, at Denainvilliers, near Petiviers, in the Province of Gatinois, by M. DUHAMEL.

S E C T. I.

Observations made during the year 1755.

M. Duhamel has given in each of his volumes, an abstract of the state of the weather, and of the effect it had upon the health of animals and the growth of vegetables. The whole series of his observations on this subject is the less necessary, as the state of the weather is generally mentioned in the account of the experiments. We shall therefore give only his observations during the two last years, as a model for others to follow.

JANUARY.

The weather was very cold all this month: M. de Reaumur's thermometer was almost continually below the freezing point: on the 6th at noon, it fell to ten degrees below freezing; and on the 8th, in the evening, to 11 degrees.

The greatest variations of the barometer were from 27 to 28 inches, and one twelfth.†

But little rain fell this month. The continual frosts prevented cultivating the earth.

FEBRUARY.

The cold continued all this month. On the 4th, in the morning, the thermometer fell to eight degrees and an half below the freezing point: consequently no ground could be plowed or hoed.

The barometer was always very low: on the 7th, it fell to 26 inches and an half: some rain fell that day, and the wind was very violent.

MARCH

* Those who would compare M. de Reaumur's scale with that of Fahrenheit, which is more generally used in this country, may consult Dr. Martin's Essay on the Construction and Gradation of Thermometers.

† The English inch is to the French inch, as 1000 are to 1068.

MARCH.

Though the thermometer was but 1 degree below the freezing point, on the 3d, in the morning, the air continued sharp. The barometer fell again to 26 inches and seven twelfths; and on the 6th and 7th, to 26 inches and ten twelfths.

Tho' some rain fell from time to time, yet the wind and sun soon dried the surface of the earth. However, our farmers went hard to work, to get their grounds ready for the spring corn. This labour had been greatly retarded: but before the end of the month, they began to sow oats, which came up very soon.

APRIL.

The temperature of the air changed suddenly, and became as hot as in summer. The thermometer was several times 15 degrees above the freezing point, in the morning; and on the 15th and 20th, at noon, it was 26 degrees above it.

This warmth put in motion the sap, which had remained till then in a kind of inaction. By the 15th, the trees were as full of leaves as they generally are in the middle of May; and towards the end of the month, the vine had leaves as broad as one's hand.

The corn was very green; but the oats that were sown after March, being in too dry a ground, did not rise.

The same warmth which quickened the vegetation of plants, gave birth to a prodigious quantity of caterpillars of all kinds. The fields were likewise full of gnats and bugs; and, in general, all sorts of insects appeared in great quantities. Some eat up the leaves of the trees, and others attacked the blossoms of pears and cherries; so that, in a short time, both woods and orchards were stripped of their leaves and fruit.

Towards the end of the month, some small showers fell, which were of great service to make the oats rise. On the 29th and 30th, there was a hoar-frost: but as the sun did not appear in the morning, it did no damage.

Some showers of hail fell in our neighbourhood, and damaged the young buds. The apricot and peach trees knit their fruit perfectly well, and were the only trees that seemed to promise plenty.

Notwithstanding the rains which I said were of service to the oats, the

the earth remained dry and cracked in its surface, as it generally is in July and August: but luckily it was moist beneath that upper crust. The barometer was always high enough, and rose on the 15th to 28 inches.

MAY.

On the 3d, the sky was clouded all the day: distant thunder was heard; but no rain fell, though greatly wanted for the spring corn.

On the 5th, it froze pretty hard: the vineyards which lay low were greatly damaged: those upon high grounds suffered little. On the 8th, it hailed: on the 18th, we had neither thunder nor rain; but at Etampes, which is 21 miles from Petiviers, there was a great storm, which chill'd the air so much, that people were obliged to make fires.

The frosts which happened from time to time during all this month, were hard enough to destroy all the vines: but, as I observed before, those upon the high grounds were but little hurt; which may be imputed to the great forwardness they were in: for, in general, the buds of the vine do not begin to open till about the 10th of May; whereas their leaves were this year, at that time, as broad as one's hand. The shelter which these leaves afforded, added to the more than common hardness of the buds, was probably what prevented the frost from doing much hurt; especially as numbers of buds were frozen at the point.

Notwithstanding the frosts we have been speaking of, the caterpillars and other insects continued to do great mischief; insomuch that the pear-trees, and almost all others, were left as bare as in the middle of winter: and afterwards those insects, unable to subsist any longer there, fell upon the peach, cherry, and other trees, which they very rarely attack.

Tho' the earth was very dry all this month, the sky having been frequently clouded, the oats which had been benefited by the rains in the preceding month, continued to rise, and the others increased in strength.

Great numbers of children were attacked with violent whooping-coughs, of which several died. Some grown persons too were attacked with the same disorder.

JUNE.

Towards the end of last month, the horizon was covered from east to south with thick clouds, the fore-runners of a storm of hail, thunder, and rain, which did a great deal of mischief in the Limosin and Berry. From that time, the same part of the sky remained continually covered with heavy clouds, which made us hope we should have rain. In effect, it did rain pretty often in the Limosin; but we had not the same advantage. It is commonly observed, that in dry years, it rains oftener than elsewhere, in those places where great showers have fallen some time before. Perhaps the reason may be, that the exhalations which rise from the earth in those places meeting those which form the clouds, make them fall down in showers of rain.

On the 4th, we had a small shower of pretty large hail, and some claps of thunder were heard. One of our elms, the trunk of which might be 14 or 15 inches in diameter, was broken in two by the thunder; and two of its greatest branches were carried away to a considerable distance.

On the 12th, the sainfoin, which had remained very low, was hopped. The corn, tho' not tall, made a good appearance; and the vines were in full blossom. The small kinds of grain were in great want of water. The hasty rains which fell from time to time did a great deal of good in several places: but, in general, they were not plentiful enough to moisten the earth thoroughly, and were only just sufficient to keep the oats from perishing. Accordingly, the ponds in most of the villages near us were dry.

The thermometer rose several times this month to 27, 28, and 29 degrees above freezing: and the air may be said to have been hot and dry during all this month.

Towards the middle of the month, part of the caterpillars being metamorphosed, a prodigious quantity of all sorts of butterflies appeared.

By the 18th, the orange trees were in full bloom. By the 25th, we had early apricots upon the table. Amel, or starch-corn was cut on the 28th, and the rye drew towards a state of maturity.

JULY.

JULY.

On the 12th, at noon, the thermometer marked 25 degrees. On the 18th, walnut-kernels, and common apricots were brought to table.

The drought continued till towards the end of this month. The corn began to be reaped the 20th: but it was very low, and a great deal of it was parch'd and shrivel'd. Rain was greatly wanted; especially for the oats. It began to fall plentifully about the 18th; and as the corn was then ripe enough to begin to cut it, our farmers soon complained that they had then too much wet. In effect, the rains which fell after that time did great hurt.

By the end of the month, the grapes for making verjuice were very fine in the vineyards; and the early grapes against walls or espaliers had already begun to turn. By the 31st, partridges were very fine and fit for killing.

AUGUST.

The rains continuing in the beginning of this month, and at the time when the harvest was above half over, the corn that was cut, sprouted in the field, and was absolutely lost. That which still remained standing began also to sprout, when, at length, the rains ceased. This last may still turn to some account, tho' it is very white and full of moisture. Happily, but little rain fell during the rest of this month, tho' the sky was continually clouded, and the air very cold. All the corn was got in by the 15th.

The moisture which was so prejudicial to the wheat, was of singular service to the oats, which were cut as they ripened. Tho' the coolness of the air checked the progress of the vine, the grapes began nevertheless to turn. The wet rotted great quantities of apricots. As for peaches, there was plenty of them, but they were pale, and had no flavour.

Notwithstanding the rains in the beginning of this month, we were over-run with caterpillars, which, after stripping the trees, fell upon the vines that were near them.

SEPTEMBER.

This month was, in general, cold and dry. The vintage was begun about the 15th, in very fine weather, and ended about the

21st, after some days of cold rain. The grapes that were gathered first, fermented very soon: those that were gathered later, were some days before they began to grow warm. The wines were made so expeditiously, that they were all tunned by the beginning of October.

Towards the 25th, saffron began to be gathered. If the crop of this flower had been greater, much of it would have been lost, because the season for gathering it happened just at the time of the vintage.

OCTOBER.

The sky was over-cast almost all this month, tho' we had but little rain: consequently the earth was well disposed for plowing and sowing. The farmers took advantage of it; and most of their lands were sown by the 10th. The rest of this month was employed in giving the winter fallow.

The late peaches did not ripen thoroughly.

NOVEMBER.

It rained almost every day this month, and the wind was often very high. So much rain fell, that ponds were formed in several stiff grounds, where the farmers were not able to continue their tillage. The river Essonne was swelled considerably. The corn came up very finely; and, notwithstanding the rains, preserved its verdure tolerably well in grounds not stiff enough to retain the water.

On the first of this month, a day remarkable for the earthquakes that were felt in Portugal, Spain, France and England, a very cold north wind blew. The thermometer was 2 degrees and an half above the freezing point; and on the 2d, 1 degree. The barometer was at 27 inches and eleven twelfths; on the 2d, at 27 inches and twenty-one twenty-fourths; on the 3d, at 27 inches and three fourths; on the 4th, at 27 inches and five twelfths; and on the 5th, at 27 inches. That same day, it thundered, and we had a shower of hail, with a strong wind. The quicksilver was very low all this month.

I am the more particular in my account of the rise of the quicksilver, because of the relation it may possibly have with the earthquakes, which were very little felt in our province, where, however, some

some persons, who could not be informed of the earthquake at Lisbon, asserted that they perceived some slight shocks.

DECEMBER.

The sky was cloudy almost all this month, and it rained almost every day. The air was mild enough; there being only a hoar-frost on the 22d and 23d.

The continual rains rendered the roads impassible. The cornlands were full of standing waters. However, the corn kept up where the soil was not too stiff; but it suffered in black and clayey grounds. As it was impossible to plow, the farmer's works were greatly retarded.

General idea of the temperature of the air, and of the productions of the earth, during the year 1755.

THE winter was very long and severe, for the frosts still continued in January and February, and the thermometer fell to 14 degrees in the month of January. But little rain fell during these two months, nor in March or April. As the air continued very sharp, the sap of plants remained without motion: but the month of April being so warm that the thermometer rose to 26 degrees above freezing, vegetation made a great progress: trees blossomed and were covered with leaves, and by the end of that month the vines had leaves as broad as one's hand. In the beginning of May, the air grew so cold on a sudden, that there was reason to fear for all fruit-trees, and particularly the vines: and if no great harm did ensue, it must be ascribed to the drought, which, as well as the chillness of the air, still continued during all June, and till the middle of July. From that time, we had almost continual rains, which were as prejudicial to the wheat, as they were favourable to the spring corn. These rains hardly ceased at all during the whole month of August. September and October were very dry, and the air was still cold: and lastly, a great deal of rain fell during the months of November and December, which passed almost without any frost.

WHEAT.

The winter, the spring, and part of the summer having been very dry, the straw of the wheat did not grow tall, but the ears were fine enough.

enough, and the grain was of a good quality, tho' somewhat small. However, a great deal was parched and shrivelled on high soils.

The harvest was begun in very fine weather: but before it was finished, such continual rains fell, that all the corn that was cut, sprouted, and was entirely lost. What was standing, fared better: but the result was, that the corn of this harvest was of three very different qualities. That which was housed before the rains came on, is very good: that which was housed before the rains fell, has no flour in it, and is hardly fit even for poultry: and that which was standing at the time of the rains, is full of moisture, yields but little flour, and will be very difficult to keep.

Old wheat has been sold for 14 or 15 livres (12 or 13 shillings) the sack, weighing 240 pounds; and the new has fetched from 10 to 12, according to its degree of dryness.

OATS.

We have seen by the foregoing account of the months of this year, that the tillage for spring corn was greatly retarded, and that the oats which were sown first were benefited by some showers of rain which made them rise: those which were sown late, were a long time before they appeared, and as they rose at last only by the help of sudden showers, some were much forwarder than others.

The drought, which was almost continual till the middle of August, gave room to fear lest the harvest of this grain should fail entirely: and indeed, notwithstanding those flying showers, the crop of oats was but indifferent both in quantity and quality. Those of our province are white and light, and sell for only five livres a sack, whilst old oats sell for six.

BARLEY.

Almost all the barley in our parts was burnt: but this accident can hardly have been general, since the price of this grain is nearly the same as that of oats.

RYE.

We raise but little rye in our province: each farmer sows just as much as will yield him straw to make what bands he wants for tying up his sheaves, and other such like uses. This grain fared nearly as the wheat did,

LEGUMINOUS PLANTS.

There was great plenty of garden beans this year: but the crop of peas, lentils, and kidney-beans, was but middling.

POT-HERBS.

Turneps of all kinds abounded. Some, of which I had the seed from Scotland, were 20 inches in circumference. Cabbages were very plenty, but their hearts were small. The beet-roots, carrots, and scorzoneras which we cultivated with the horse-hoe, grew to a surprizing bigness; far beyond any in the best kitchen gardens. Artichokes yielded plenty of fine heads in the spring, and again in autumn, so that we had them till December.

HAY.

As the sainfoin blossomed in the dry seasons, it remained stunted: but its quality was very good.

The meadows in general yielded but little hay; and even that, being wet in most places after it was cut down, was scarcely good for any thing. Our meadows, which are extremely well cultivated, were as well covered as in the best of years; and as we got our hay in dry, its quality was very good.

THE MALT.

Hemp did not grow high this year; but, that excepted, it was very good. What was sown in grounds bordering upon water, succeeded much better than any other.

WINE.

The vines that were nipped by the frosts in the spring, yielded but little wine, and that sharp and flat. Other vines yielded the value of a good half year. The grapes fermented as soon as they were put into the tub, and as the froth subsided very quickly after, the wines were made in a few days. Most of these wines have colour enough; but, in general, the old wines deserve the preference.

FRUIT.

The caterpillars having devoured all the verdure of the apple, pear, and plum trees, we had none of those fruits this year. Our oak

trees

trees shared the same fate. We had few cherries, but quantities of apricots and peaches. The beech trees, and the chestnut and walnut trees in our neighbourhood, yielded likewise but little fruit: but in some other places there was abundance of nuts.

NURSERIES and PLANTATIONS.

The drought of the spring and summer was by no means favourable to nurseries and newly planted trees. The caterpillars which devoured the tender shoots, did them a great deal of harm.

SAFFRON.

Tho' the crop of saffron was very scanty, it did not sell for above twenty livres a pound. I have been assured that the commissioners of Petiviers brought the saffron of the Gatinois into disrepute, by wetting it, in order to increase its weight; which made it ferment.

INSECTS.

There was a prodigious quantity of all sorts of insects, and especially caterpillars, which devoured the verdure, and eat up the tender shoots of plants, not yet strong enough to resist them. They attacked most kinds of fruit, and even fell upon trees which they generally spare, such as the vine and peach tree. I observed that they eat the violet peach rather than any other, and that even the leaves of that tree did not escape them. I must however except the cabbage caterpillar, which did no mischief this year. There were but few gnats, and very few cantharides.

DISTEMPERS.

There were no epidemical or contagious distempers in the course of this year.

CATTLE.

Neither sheep, cows, nor horses, were attacked with any contagious distemper. The scarcity of fodder last year, made butcher's meat, and particularly veal, very dear: butter too kept up at a higher price than usual.

GAME.

We had plenty of partridges and hares; but few quails and larks. The last year's snow had destroyed prodigious quantities of them.

BEEs.

BEEs.

The bees could lay in but a small stock of provisions last year, on account of the scarcity of flowers, occasioned by the drought of the season. Three fourths of our hives perished with hunger during the winter, and we had very few swarms.

HEIGHT OF THE WATER.

All our high springs became dry, and remained so, notwithstanding the rains in November and December: but our springs in low grounds continued to run plentifully.

S E C T. II.

Observations on the Year 1756.

JANUARY.

THIS month was mild and wet: it rained almost every day: we had only some hoar-frosts, and the thermometer was never more than three degrees and a half below the freezing point. The earth was so wet, that no ground could be tilled, nor could any carriage go in the fields. The legs of the horses of our stage waggons, by being always in the water, swelled. The skin peel'd off afterwards with the hair, and no bad consequence ensued.

The quicksilver of the barometer was in continual motion: its variation extended from 27, to 28 inches and a half.

On the 13th, at night, we had a furious blast of wind, which happily lasted but a quarter of an hour.

FEBRUARY,

This month may be said to have been a mild one, tho' there was a hoar-frost almost every morning. It may likewise be said to have been wet; because, though we had no heavy showers, yet the sky was almost constantly clouded, and small misting rains fell very frequently.

The barometer varied greatly and suddenly during all this month. It rose to above 28 inches and one-sixth, and fell below 26 inches and a half.

In the morning of the 18th, on which day some shocks of an earthquake were felt at Paris, and in other places, the thermometer

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was

was at three degrees of M. de Reaumur's scale. Towards six o'clock in the evening of the same day, the wind, which had begun to rise at noon, was excessively violent, and the quicksilver in the barometer was fallen below twenty six inches and a half. On the 20th, it rose to 28 inches and one-sixth. These violent shocks in the atmosphere had probably some connection with the earthquake for it was observed that the rise of the quicksilver had no sort of relation to the rain, the wind, or fair weather. During this month, the ground was plowed for spring corn; and towards the end of it, oats began to be sowed.

MARCH.

Slight frosts were very frequent during this month; and the wind, which was almost always pretty violent and cold, rendered the air very disagreeable.

The barometer was again subject to great variation. It rose to 28 inches and one-twelfth; and fell to 26 inches and ten-twelfths.

Tho' the sky was very often clouded, we had so little rain, that this month may be said to have been a dry one. However, the oats that were sown in ground which had been well moistened, rose well.

APRIL.

The wind continued cold and disagreeable, and the sky frequently clouded: yet we had but little rain; and the earth was very dry. Some oats were sown again this month.

The farmers were busied with their fallow grounds; and those who had vines gave them the first spring dressing.

Caterpillars appeared in great abundance: but the cold rains and the sharpness of the air not agreeing with them, they did the less damage to our trees and plants.

MAY.

We had some frosts, especially on the 2d and 3d of this month, so hard as to hurt our vineyards. Some suffered more than others, according to their situation and circumstances. In places where flying showers of hail and rain had fallen, the vines suffered greatly: where there had been plentiful rains, they were less hurt; and where they had not had any rain at all, they were but very little damaged. The vine-dressers took advantage of the rainy weather to set up their vine props.

The caterpillars remained on the trees where they were hatched. There were such prodigious quantities of them, that the oak trees in the forest of Orleans and other woods where they had not been destroyed, were as bare as in the middle of winter. However, these insects suffered greatly from the sharpness of the weather; and especially the common sorts, which are those that do the greatest mischief, because they eat the buds which should form the next year's shoots. These common caterpillars were so weak and flabby, that they bent and hung down quite motionless when they were taken up betwixt one's finger's: so that they did but little hurt, especially where care had been taken to destroy them; and most of them died within this month.

The spring corn that was sown in April, did not rise in dry ground: but the rain on the 25th, gave hopes of its coming up; and it was thought that this rain would be equally serviceable to the wheat, which began to grow red: but that grain wanted warmth as well as moisture.

At the end of the month, sainfoin was in blossom, but greatly stunted in its growth.

JUNE.

Tho' the earth was always moist during this month, the corn did not tiller, nor did it spindle without difficulty, by reason of the coldness of the air. Its blades rusted, and the plants remained greatly stunted. The sainfoin which was cut towards the end of the month, was likewise very short. Weeds, particularly blue bottles and poppies, got the better of the wheat. The spring corn was very fine.

The cold and wet killed the caterpillars in great numbers; and by the end of this month, all of them had disappeared.

JULY.

This month was so wet, that the roads were as impassible as in the depth of winter: the air was so cold that people cloathed themselves as in winter, and were obliged even to make fires. However, the vines blossomed; but so slowly, that many were not out of bloom by the 15th, which gave room to fear that the vintage would be very late. On the 10th, the vines began to be tied up to their props.

At the same time the rye began to turn yellow, and a few

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warm

warm days would have made it fit to cut: but the continual rains retarded the harvest of that grain till the end of the month.

The wheat was very short, and full of weeds, particularly poppies, blue-bottles, and fox-tails. As the seed of this last cannot be separated from the wheat, it lessens its value considerably; because it gives the bread that is made of it, a bitter taste and a purplish colour.

Oats were very fine, especially where the soil was light. Barley and peas were also very fine: the grapes burst, especially those which grew on stiff lands,

An epidemical distemper attacked the poultry: this was the pip, and cancers in the throat. The former was cured by cutting the tongue; and for the latter, a finger was thrust into their gullet, which was rubbed with salt, and their throat was afterwards washed with vinegar. These fowls voided a great deal of slimy matter, and several of them recovered: but as young chickens could not be treated in this manner, many of them died.

AUGUST.

As we observed in the account of last month, the rye harvest did not begin till the end of July: consequently our farmers were busied with that work in the beginning of August. To the rye, succeeded the wheat harvest, which was begun and finished without interruption. The sky still continuing cloudy, and threatening rain, people were in such a hurry to house their corn, that they did not give the weeds, which the sheaves were full of, time to dry. The consequence was, that the corn piled up in barns, heated to that degree, that many were obliged to bring their sheaves out to air them.

Luckily, notwithstanding the uncertainty of the weather, which seemed every day to threaten rain, we had not had much wet. The wind continued north, and very sharp.

As the wheat was low and thin, part of it was mowed, and so great a quantity of weeds was gathered up with it, that some farmers who took the pains to separate them very carefully, found that they had two thirds more weeds than they had wheat.

After harvest, the new seed corn, which was greatly inferior to the old, was worth from 22 to 24 livres * the *septier*, which weighs 240 pounds: and the old 20. The same measure of oats sold for 5 livres

* From 19 to 21 shillings.

livres 10 sols, or 6 livres. From 30 to 40 sheaves were requisite to make a *mine* of 80 pound weight.

The grapes did not begin to turn till the end of this month, and some kinds of them were greatly hurt by their bursting.

SEPTEMBER.

The air was cold during all this month, which was rather wet than dry. The rains did great injury to the grapes, which, in several places, rotted or dropt off before they were ripe; and in others, the vines lost their leaves, and the grapes withered: so that, towards the end of the month, nothing was more common than to see grapes of different degrees of ripeness; which made those who were sufficiently provided with proper vessels, determine to make their vintage at two different times. Towards the 20th, great numbers of starlings and thrushes appear'd. I know not for what reason they were not so fat this year, as they generally are when there is plenty of grapes.

OCTOBER.

During this month, the weather was very sharp, but the air was clear, and we had no wet.

The vintage was begun about the 6th; and those who could cut their grapes at different times began with the red, the fruit of which was sufficiently coloured, but not so sweet as it should have been. This wine was pale, but is the best of the year.

The vintage was not yet finished, when the saffron began to blossom: but as the air was sharp and dry, the flowers did not open all together, so that people had time to gather them, and none were lost. Their chives, which are the useful part of this flower, were of a good quality.

Our farmers began to sow on St. Denis's day, and, their grounds being in good order, finished that work by the end of this month, when the first sown wheat had already risen.

NOVEMBER.

The air was very cold all this month, and the sky almost continually cloudy.

Some few grounds which had been left un-sown last month, were sown in the beginning of this.

DECEMBER.

DECEMBER.

As it froze almost continually during all this month, the culture of the earth was interrupted, and our horses were employed in bringing wood from the forest; which could not be done in the summer, on account of the badness of the roads.

General idea of the temperature of the air, and of the productions of the earth, during the Year 1756.

WE may be said, in general, not to have had any frosts this winter, since there was not ice enough to fill our ice-houses. The air having been cold all the summer, the vegetation of plants made but little progress, tho' the earth was always very moist.

WHEAT.

The corn came up very thin, and tiller'd but little. The wetness of the weather made weeds grow, which, in many fields, got the better of the corn, and choaked it. The rust which affected the blades of corn, stopt the vegetation; so that the plants were greatly stunted in their growth. These accidents did more hurt to the grain that grew on stiff ground, than to that which was on lighter soils. As we were threatened with rain during the harvest, our farmers housed their corn before the weeds were well dried: the consequence was, that some of it heated so in the barn, that part of the grain was injured. Those who used this grain for seed, perceiving that it had been hurt, sowed it very thick: but several others sowed much too thin. The worst was, that many poor farmers, finding their corn not good enough for sowing, left part of their fields unsown, rather than buy other corn, which was then worth 24 livres, and was expected to fall to 18, after the harvest.

Twenty-four sheaves of the best corn of this year's growth will not yield above 80 pound weight of wheat; and, taking them one with another, there must be near 30 sheaves to produce that quantity; though 12 will do it in a good year. This is not all: the *septier* of the best new wheat makes but 18 or 20 loaves, and sometimes but 14 or 15; whereas good old wheat makes 24. Notwithstanding this difference, the old wheat sells for no more than 24 or 25 livres, whilst

whilst the new varies, according to its quality, from 18 to 21 livres the *septier*.

OATS.

The best lands did not yield the most oats this year: on the contrary, the worst produced the greatest quantities; which has made people call this a good year for that grain. Its quality is good, and it is worth from 5 livres to 5 livres 10 sols the *septier*.

BARLEY.

Barley too succeeded very well.

LEGUMINOUS PLANTS.

There was sufficient plenty of peas, beans and lentils.

POT-HERBS.

Our kitchen gardens were well stored with pot-herbs: and, notwithstanding the continual rains, and the coldness of the air, all our melons were very good.

HAY.

As the sainfoin was very short when it was cut, there was consequently but little of it: but its quality was good. The meadows afforded plenty of grass; but the almost incessant rains prevented its being got in in time, and a great deal of it was lost.

HEMP.

This year's hemp was of a good quality, and succeeded even in pretty dry grounds.

WINE.

The white grapes having burst very much, the quantity of fruit upon our vines was, in fact, not great: but what there was, promised extremely well till about a month before the vintage, when the sharpness of the air made the grapes drop off the bunches, and the bunches themselves rotted or withered; which obliged many people to make several vintages, in order to save as much as they could. In consequence of this, the price of old wine rose from 60 to

to 100 livres a hoghead: and the best new wines sold for only 50 livres. The quantity of these small wines, which may be compared to those of the year 1725, was not great.

FRUIT.

The caterpillars having eaten up all the leaves, and even the buds for the next year's shoots, in the autumn of 1755, the trees had but few blossoms on them. The caterpillars this spring destroyed all that had escaped those of the last autumn; so that there were neither pears, apples, cherries, apricots or plums, and very few peaches, in great gardens.

In small ones, where constant care was taken to destroy the caterpillars, there was a little fruit, especially apples. Wild fruit, such as the acorn, the beech-mast, &c. failed entirely: but there were nuts and chefnuts in pretty great abundance.

NURSERIES and PLANTATIONS.

Tho' the caterpillars devoured the first tender shoots of trees; yet, being full of sap, they afterwards recovered.

SAFFRON.

This year's crop of saffron was excellent in quality, but very small in quantity: for the same space of ground which had produced from 26 to 28 pounds two years before, yielded this year but 5 or 6: and the saffron of this year's growth sold for no more than 19 livres a pound; whereas that of two years before sold for 24 livres.

DISTEMPERS.

There was no contagious epidemical distemper this year.

CATTLE.

The larger kind of cattle, such as horses, cows, and sheep, were not subject to any contagious distemper.

GAME and POULTRY.

This year there were great quantities of hares, thrushes, larks, partridges and quails.

Our

Our dove-houses afforded but few young pigeons: and tho' the poultry had plenty of water, numbers of fowls were attacked with the pip and shankers in the throat. We have already said how they were cured of these distempers.

HEIGHT of the WATER.

Our rivers were greatly swelled during all the winter: they were likewise very full all the rest of the year: but yet our high springs did not afford any water.

THE END.



Our dove-houses afforded but few young pigeons: and the poultry had plenty of winter, numbers of towns were attacked with the pip and shankers in the throat. We have already said how they were cured of these distempers.

HEIGHT OF THE WATER.

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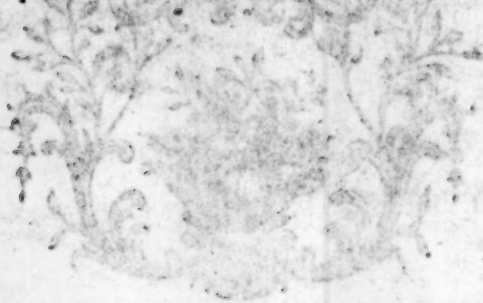
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